Indian Temple Architecture

Analysis of Plans, Elevations and Roof Forms

Volume-I

Ananya Gandotra

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The book unravels with effective use of computer technology the uniformity, great proportions and geometry that the Hindu Temple Architecture is based upon. The book also challenges and readdresses the predominant theories of temple architecture like the *Vastu Purush Mandala* and the *Sri Yantra*. It sets forth the theory that there is an evident micro level integration of dimensions and proportions which all originate from the idol, set in the womb of the structure: the *Garbhagriha*.

The book unfolds the relationship between the 'square' and the 'circle' in a sequence which, with the help of the stellate square form with its intersecting points, the *marmas*, resonates throughout the temple's space and form in conjunction with its subsidiary shrines. It also establishes with the help of SCS, a strong relationship between the *prasada* and the *mandapa*. The potent intersection of the two SCS sets the canvass for erotic iconography as evident in temples of Khajuraho.

This three volume book establishes the interdependency of the temple's elevation and its roof form to the plan and its dimensions, setting forth the need for the scholarship to address the temple structure as a whole. With the use of examples from different time and space, the book establishes that the temples underlining design principles remain the same, smallest denominator being the unit dimension of the idol, Shiva lingam or the idol pedestal. Therefore, the later date typologies were of no relevance to the *sthapatis* of these manifestations.

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SHASTRI INDO-CANADIAN INSTITUTE
5, BHAI VIR SINGH MARG, NEW DELHI - 110 001, INDIA
TEL : (11) 2374-2677, 2374-3114, 2374-6417 FAX : 2374-6416
E-MAIL : sici@vsnl.com WEBSITE : www.sici.org

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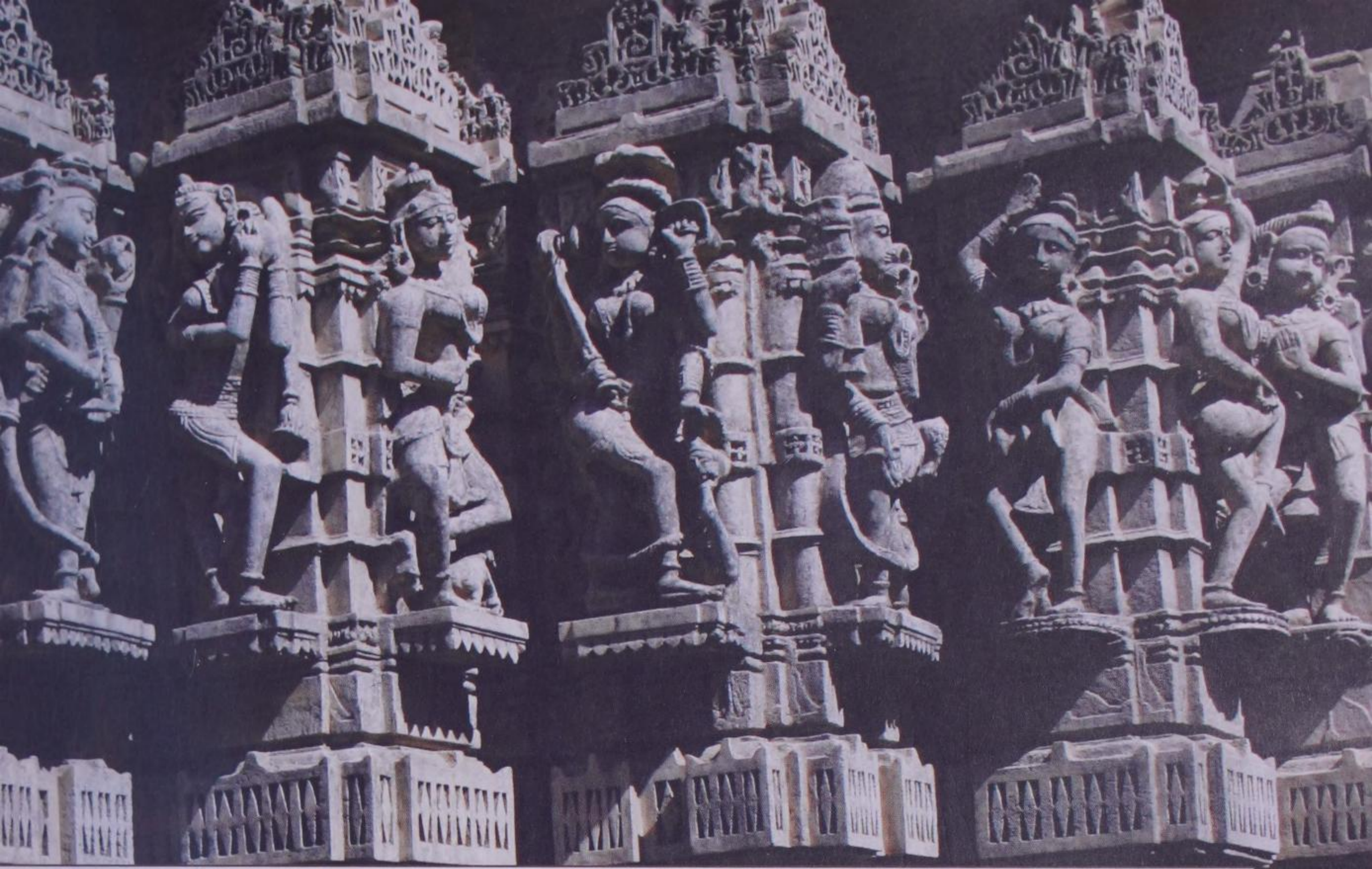

Contents

Prologue....10 | Introduction....14 | Analysis of Symbolism....50 | Development of the 'Square-Circle-Sequence' Diagram & its Governing principles....58 | Extracting Possible Solutions from texts on Sculpture and the Natyasastra....70 | An Analysis of Sri Yantra and its Application in Temple Architecture....80 | Mandala - An Incomplete Tool for Analysis of the Temple Plan....98 | Applications of SCS Method....108 | Solving the Complexity of a Complex Temple Layout with the SCS Method....124 | Bibliography....167 | Glossary....176 | List of Figure....197

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Analysis of the Temple Plan

Indian Temple Architecture

Analysis of Plans, Elevations and Roof Forms

Volume - 1

Prologue

The geometrical analysis of a Hindu temple is a very complex one because the complexity exists at various plan, elevation and roof levels. I have derived a method which would not just be able to resolve the complexity of the temple plan but be able to address the temple as a complete form. The generic method developed, termed as 'Square-Circle-Sequence' (SCS) can be widely used for all the various Indian temple types. A detailed description of its general properties is given and with the help of specific examples its application is justified. It establishes a relationship between the deity, the sanctum (*garbhagriha*) and temple façade and structure. It directly refers to the Kramrisch's chart[1], 'proportions of the temple as prescribed by ancient text' which, I have simplified by adding visual diagrams and general formulas. It is useful in establishing a relationship between the proportions between the various parts of the temple structure. A study relating to the proportions of the temple structure and also the placement and proportions of the subsidiary shrines and the enclosing walls has been done for the Brihadeshvara temple Complex, Tanjavur, Tamil Nadu, *ca.* A.D. eleventh century and Brahmeshvara temple at Bhubaneshwar, *ca.* A.D. 1060. The missing links in the analysis of Mundeshwari, Shahabad District, Bihar, *ca.* A.D. early seventh century, which uses orthogonal grid '*mandala*' as a tool for analysis, have been addressed. The geometrical analysis of the two stellate temples Chennakeshva temple, Nagalpura, Karnataka, *ca.* A.D. 1200 and Jagadamba Devi, Kokamtham, Maharashtra, *ca.* A.D. Fourteenth century have also been shown.

The study critically analyses the role of the *vastupurushmandala* as a definitive tool for design and construction of the temple structure. The *sri yantra* whose possible application has been restricted to the Orissan temples is taken up in detail, besides showing the various detailed steps of its construction and its possible application for the temple plan and elevation.

In Volume I, I will be introducing a comprehensive and coherent design and geometrical analysis method termed 'Square-Circle-Sequence' (SCS). We will

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[1] Stella Kramrisch, *The Hindu Temple* 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996).

also explore the role of the enshrined deity in governing the Temple Design and Planning. Further, I have taken an Analysis of the '*vastupurushmandala*' concept besides a brief summary on Symbolism in Sacred Architecture. In volume I, I will develop the Square-Circle Sequence for Temple Design and Planning and give the general properties of the SCS. A lot of thought has been given to the Squaring of the circle and its symbolic connotations.

In volume I, I will also establish the Ratios between expanding squares of SCS, Location of *Garbhagriha* with respect to SCS. The issue of the first square/ circle of the SCS will also be resolved. I will also deal with issues like, 'Extracting Possible Architectural Solutions from texts on Sculpture', 'Derivations from the Four Actions of a Sculptural Diagram namely the Setting and Polishing Action'. Although the classification of the study of the temple is primarily divided into, the two major categories of the *Nagara* and the *Dravida* the thought that there exists a common design guideline for architectural design and construction is propagated by adopting various example in different time and space in this volume.

In Volume II, I will be detailing the comprehensive and coherent design and geometrical analysis method termed 'Square-Circle-Sequence' (SCS). We will also explore the role of the enshrined deity in governing the Temple Design and Planning. The study on *Rekha* and the relationship between the plan of a temple to its elevation besides a possible method of deriving '*rekha sutra*' through SCS and its analysis is deliberated on in this volume.

The Volume III, I will be dealing with the roof plan as well as the form of the *Shekhari* temples of Northern India. The study will also address the need to study temple architecture in totality rather than isolating it into parts. Besides a methodology of developing roof plans will also be introduced. With the help of examples the possible use of SCS for developing a roof plan will also be taken up here.

Un, Madhya Pradesh

Right page top Small Jain Temple
Indore, Madhya Pradesh

bottom Shiv Temple, Garhi,
Madhya Pradesh

1-Introduction

1.1 A Coherent and Comprehensive Approach to study Ancient Indian Temple Architecture

Although Indian temple architecture has been widely studied and documented, analysis of the geometry of temples, which governs its planning and the overall form, is still in its initial stages. Whatever study has been conducted on the architectural planning and the geometrical principles of Indian temples have lacked a coherent and comprehensive approach to study architectural form, while addressing a temple's plan and its elevation along with its roof form. Previous studies on temple geometry can broadly be sub-divided into these three separate areas of ground plan, elevation and the roof plan. Since this gives a very restricted and two-dimensional perspective on temple architecture, there is a need to find a method of analysis which could incorporate all these three aspects of temple design and its geometry. The methodology developed in this book reveals a logical system of design and planning which I term 'Square Circle Sequence'. When this is applied to existing examples of Indian temples, some remarkable results are achieved. It should be borne in mind that ancient Hindu temples are not purely examples of the architectural, sculptural and structural skills of the ancient architects and craftsmen, but also embody philosophical, cosmological, metaphysical, astronomical, astrological, geographical and geological knowledge. The system proposed in this study is likely not to have been simply a matter of practical geometry, but also to have been deeply rooted in a religious system, as suggested in the ancient texts. Much ancient literature exists providing insights

into the dwellings of the gods, not least the *Vedas, Shastras, Puranas, Tantras* and *Agamas*. In particular, direct references to temple architecture are found in *shastras* such as the *Vishvakarma Vastu-shastra, Samarangana-sutradhara, Aparajita-prccha, Manasara, Mayamata* and *Silparatna*.

1.2 Application of Modern Computer Technology

This study exploits the immense potential of modern computer technology, which can not only efficiently draft complex structures with precision, but can also at the same time be effectively be used as a tool for testing various theories, particularly concerning measurement and geometry. Although computers are widely applied in architectural studies and practice, their potential use to a vast range of applications in research on historic architecture remains unexplored. Although this study focuses on medieval Indian temple architecture, the methodology adopted for it can be applied to similar studies in other fields of architectural history. There is a need to add this new technological dimension to the study of ancient Indian temple architecture through the adoption of computer applications, which incorporate a precise, interactive and efficient system for analysis and documentation. The study made in this book on the construction and application of the *Sri yantra* (Frontispiece) to the temple plan and elevation is intended to provide a model for understanding the relationship between the philosophy underlying Hindu temple architecture and its practical applications.

Batesvara Mahadeva complex, Batesvara,
Distt Morena, Madhya Pradesh Ninth Century

Hanuma Temple, Tongara,
Shivpuri, Madhya Pradesh

1.3 Previous studies on temple geometry

1.3.1. Temple Plan

A brief survey of previous studies on temple geometry need to be made here. Alice Boner[2] has used, directly translated extracts from the *Silpasarini*, an ancient Orissan text, through which she has tried to find an explanation for the role of the sanctum (*garbhagriha*) in determining the placement of the various parts of the temple with respect to their size and proportions. She has also highlighted the possible use of a diagonal grid for the design of the temple plan. Hers is an example of an approach, based mainly on texts, rather than, the study of buildings themselves.

Michael Meister's contribution to the study of planar geometry of temples, stands out for introducing, an analytical applied approach to the study of temples, which had so far received little attention in relation to this aspect, so important to the understanding of the complex form of temple architecture. Some of Meister's

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[2] Alice Boner, 'Extracts from the Silpasarini', in *Studies in Indian Temple Architecture*, ed. by Pramod Chandra, (New Delhi, American Institute of Indian Studies, 1975), pp.57-79 (p.63)

Shiv Temple, Garhi, Terahi, Madhya Pradesh

studies and observations have been carefully and critically studied here. Meister lays great emphasis on the '*vastupurushmandala*' and the theory of the orthogonal grid. However, his study on the Shiva temple at Mundesvari, Shahabad District, Bihar, *ca.* A.D. 636,[3] explores, though briefly, the possible use of the circle to explain the points which do not lie on the gird, helping us to address the geometry beyond the grid and straight lines. An attempt to do away with the grid and adopt a different geometrical system for analysis is seen in a study done by Philip E Harding (2003) on Durga temple Aihole.[4]

Some other studies which are important to this field of study are the ones done by Volwahsen,[5] especially his analysis of Brahmeshvara temple at Bhubaneshwar (Bhuvaneshvara) where he very briefly shows the SCS and its origin at the wall of the *garbhagriha*. My study readdresses the wall of the sanctum as the focus and origin for the geometrical principles underlying the temple plan, going beyond this notion to show that it is in fact the image of the deity in the sanctum, rather than the sanctum, wall which generates the dimensions and the proportions of the complete temple. Another study by Volwahesen (1969) which develops the idea of the SCS is on the Brihadesvara temple at Tanjavur. Here he uses the concept of expanding squares and circles to show the spatial planning of this south Indian temple complex.

1.3.2 Temple Elevation

Studies on temple elevations are very few, notable among them being those by Stella Kramrisch,[6] where she addresses the measure of the curvature (*rekha sutra*) of the temple spire. Her theories derive from the ancient text *Samaranganasutradhara,* relating to the use of horizontal and vertical divisions for plotting the curve of a Latina *shikhara*. Her theories on curvature need scientific examination and the diagrams need to be rechecked. Besides Kramrisch, the other important work on the derivation of the curvature of the temple spire (*rekha sutra*) is by Kulkarni

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[3] Michael W. Meister, 'Mundesvari: Ambiguity and Certainty in the Analysis of a Temple Plan', in *Kaladarsana*, (*American Studies in the Art of India*) ed. by Joanna G. Williams, (New Delhi, 1991), pp. 77-89, (p.84)

[4] Philip E Harding, 'South Asian Geometry and the Durga Temple, Aihole', South Asian Studies 20, 2003, pp. 25-36.

[5] Andreas Volwahesen, *Living Architecture: Indian*, (New York, Grosset & Dunlap, 1969).

[6] Stella Kramrisch, *The Hindu Temple* 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996.

(2005).[7] He refers to the *Sutradara Mandana*, proposing that the *shikhara* is divided into horizontal segments '*khanda*', which are subdivided into 3-18 subdivisions called '*kala*'. He goes on to state that, there are 256 *rekha*s based on horizontal *khanda* and *kalas*. This theory of a fixed number of *rekha* types needs further clarification and investigation and, if applied to a study focusing on the derivation and application of *rekha* types, could yield fruitful results. Both these theories of curvature isolate the elevation from the temple plan, once again highlighting the need for an attempt to integrate the plan with the elevation and the overall form of the temple structure.

A more recent study is that of Patrick George (1998), who has analysed Temple no. 2, Bandhogarh, Madhya Pradesh, (*ca* 8th-9th century). He argues that an arithmetic progression has been used for the derivation of curvature on this temple, in which the dimensions of each layer of stone were based upon the previous one, dimensioned by some integral multiple of a fixed module. He does not give the arithmetic progression or the integral number for multiplication in his study.[8]

Meister has argued the height and curvature of *shikhara* is based on different radii of circles. This theory makes an attempt to integrate the plan to the elevation, but the resulting statement that, 'the radius of the circle is a multiple of the width of the temple at the base of the superstructure; the larger the multiple, the shallower the curvature is and the higher the temple becomes' is limiting, and needs further investigation in relation to actual buildings.[9] Meister has also asserted that 'the curvilinear tower of the North Indian temple thus forms a zone of transition between the outer dimensions of the *vastumandala*, measured by the walls of the temple, and the inner dimensions of the sanctum, marked at the top of the temple by the upper *vedi*',[10] and that 'the radius of the circle is a multiple of the width of the temple at the base of the superstructure; the larger the multiple, the

---

[7] Raghunath Purushottam Kulkarni, *Prasada Mandana of Sutradhara Mandana* , (New Delhi, Munshiram Manoharlal Publishers Pvt. Ltd., 2005).

[8] Patrick A. George, 'Counting curvature: The numerical roots of north Indian temple architecture and Frank Gehry's "digital curvature"' in *RES 34*, Autumn 1998, pp. 127-34.

[9] Michael W. Meister, *RES 12*, Autumn 1986, p. 40 and also in *God, Guardians and Lovers*, 1993, p. 105.

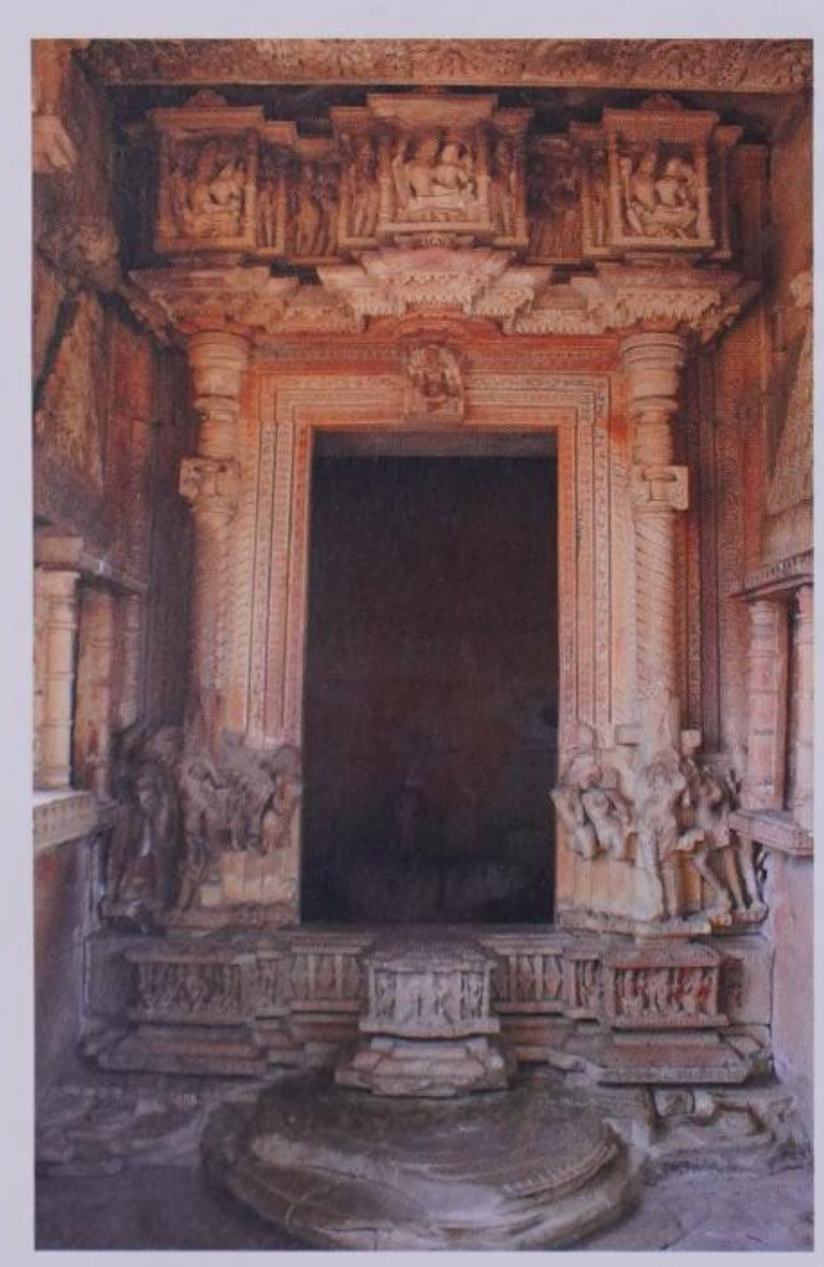
[10] Michael W. Meister, 'On the development of a morphology for a symbolic architecture', in *RES* 12, (Autumn 1986), pp. 37-9.

shallower the curvature is and the higher the temple becomes'. [11] Here, Meister has aimed to establish a relationship between the plan and the elevations, directly translating the inner dimensions of the temple on to the elevation.

1.3.3 *Temple Roof Plan*

A third aspect of the temple study is the roof plan, which completes the total form of the temple. This area has been ignored, except by Hardy, whose generic study (2002), which includes some very complex drawings of Shekhari temple roof plans, broadly classifies this temple form into five types, corresponding to increasing degrees of complexity.[12] I have taken his study forward by developing roof plans of numerous north Indian temples. Hardy's proposal, that, there is a fixed grid for some types of *Shekhari* temple roof plans, need to be challenged. His studies (1995, 1998) encourage scholarship to look beyond two-dimensional drawings and address the complete form of the structure.[13] His approach has been interpreted and applied by me in vol III, to further develop three-dimensional computer models, of parts of Lakshmana temple (*ca.* A.D. 954), one of the well-known temples at the central Indian temple site of Khajuraho.

Figure 1.1 Siva temple, Group 4, Kadwaha, Madhya Pradesh



1.4 The role of the enshrined deity in Temple Design

In the need to address the smaller nuances of the temple structures, the role of the enshrined deity, which is unfortunately often missing in existing temples and the dark unapproachable sanctum (*garbhagriha*), is often left out (Fig.1.1). The importance of these, for the architectural design of the temples can be substantiated by the fact, that there are enough mentions of characteristics and proportion of the temple deity,

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[11] ibid, p. 39.

[12] Adam Hardy, 'Śekharī Temples' in *Artibus Asiae*, LXII, No.1, (2002), pp. 81-137 (p. 81)

[13] Adam Hardy, 'Form, Transformation and Meaning in Indian Temple Architecture', in *Paradigms of Indian Architecture*, ed. Giles Tillotson, (London, Curzon Press, 1998), pp.107-35; see also Adam Hardy, Indian Temple Architecture: Form and Transformation, (New Delhi: IGNCA and Abhinav Publications, 1995), pp. 25-7.

its pedestal and the *garbhagriha* in some of the ancient texts (Fig.1.2).[14]

Module: Width of *Prasada* (W) or *Mulasutra*	
Varing grid applied on the Prasada: viz. 9 sqs. grid (3x3),16 sq. grid (4x4), 25 sq. grid (5x5), 36 sq. grid (6x6), 64 sq. grid (8x8), sq. grid (9x9), sq.grid (10x10).	
Width of the Prasada 'W_p' = X = n.x; Area of a square of the grid of the *Prasada*, A_p = X x X = 2.n.x (where the value of n = 2,3,4,5,6,8,10.. and where 'x' = width of a single grid (dimensions), 'X' is number of squares on each side of the grid of the *Prasada*, Also the Thickness of the prasada wall (T_p) is T_{pw} = n_1.x where n1 is a numerical variable.)	
Width of the Garbagriha 'W_g' = Y = m.y = m.x; Area of a square of the grid of the *Garbagriha*, A_g = Y x Y = 2.m.x (the value of Y = m.y where the value of 'm' can be can be 1,2,3,4,5,6,8,10, where 'X' is number of squares on each side of the grid of the *Garbagriha*, (since 'y' also the width of a single grid is equal to 'x'.)	
Height of the Linga = L	
Width of the jagati from the edge of the external wall to the edge of the jagati = W_j = j. W_p (j is a variable having values....)	
	'x' is the dimension of a single grid.
	'n' is number of the square grids on the *Prasada*.
	'n_1' is number of the square grids of the *Prasada* wall.
	'm' is number of the square grids on the *Garbagriha*.
	'L' is vertical dimension of the *Linga* + its pedestal.

Table: 1.a -4.b
Chart on Proportions of temple's key elements on plan and elevation. Based on Stella Kramrisch, 'Proportionate Measurement and Varieties of the Temple' in The Hindu Temple 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996), pp. 227-270.

Table: 1.b

Module: Width of *Prasada* (W) or *Mulasutra*		
Varing grid applied on the Prasada: viz. 9 sqs. grid (3x3),16 sq. grid (4x4), 25 sq. grid (5x5), 36 sq. grid (6x6), 64 sq. grid (8x8), sq. grid (9x9), sq.grid (10x10).		
Width of the Prasada 'W_p' = X = n.x; Area of a square of the grid of the *Prasada*, A_p = X x X = 2.n.x (where the value of n = 2,3,4,5,6,8,10.. and where 'x' = width of a single grid (dimensions), 'X' is number of squares on each side of the grid of the *Prasada*, Also the Thickness of the prasada wall (T_p) is T_{pw} = n_1.x where n1 is a numerical variable.)		
Width of the Garbagriha 'W_g' = Y = m.y = m.x; Area of a square of the grid of the *Garbagriha*, A_g = Y x Y = 2.m.x (the value of Y = m.y where the value of 'm' can be can be 1,2,3,4,5,6,8,10, where 'X' is number of squares on each side of the grid of the *Garbagriha*, (since 'y' also the width of a single grid is equal to 'x'.)		
Height of the Linga = L		
Width of the jagati from the edge of the external wall to the edge of the jagati = W_j = j. W_p (j is a variable having values....)		
	'x' is the dimension of a single grid.	Value of x:
	'n' is number of the square grids on the *Prasada*.	Value of n:
	'n_1' is number of the square grids of the *Prasada* wall.	Value of n_1:
	'm' is number of the square grids on the *Garbagriha*.	Value of m:
	'L' is vertical dimension of the *Linga* + its pedestal.	Value of L :
		Value of j :
		Value of p :
Calculation for the area of walls (Aw) Aw = 2 (Tpw x Wp) + 2 Tpw(Wp - 2Tpw) = 2 Wp.Tpw + 2 Tpw.Wp - 4 Tpw.Tpw = 4 Wp.Tpw - 4 Tpw.Tpw = 4 n1.x - 4 n1.x.n1.x = 4 n1.x.x (n - n1)	* Hayasirsa-Pancaratra, ch. XIII (310-17; 318f) ** Agni Purana, ch. XLII	

[14] See 'Characteristics of the linga (parabolic representation of Siva)', 'The dimensions of the different varieties of the linga' and 'The characteristics of the pedestal' in *Agni Purana*, ed. by J.L.Shastri, Part of Ancient Indian Tradition & Mythology series, Ch. 53-5, Part1, (New Delhi, Motilal Banarsidass), pp.139-146.

Table: 1.c

Module: Width of *Prasada* (W) or *Mulasutra*		
	'x' is the dimension of a single grid.	Value of x:
	'n' is number of the square grids on the *Prasada*.	Value of n:
	'n1' is number of the square grids of the *Prasada* wall.	Value of n1:
	'm' is number of the square grids on the *Garbagriha*.	Value of m:
	'L' is vertical dimension of the *Linga* + its pedestal.	Value of L :
		Value of j :
		Value of p :
Proportionate measures of the Plan of the *Prasada*	Width of the *Grabha Griha* (W_g)	$W_g = Y = X = m.x$
	Width of the *Prasada* (W_p)	$W_p = X = n.x$
	Thickness of the *Prasada* Wall (T_{pw})	$T_{pw} = n_1x$
	Area of the *Garbha Griha* (A_g)	A_g (Y x Y = m.x.m.x)
	Area of the *Prasada* (A_p)	A_p (X x X = n.x . n.x)
	Area of the *Prasada* walls (A_{pw})	$A_{pw} = 4.\ n_1.x.x\ (n-n_1)$
	Nemi, the zone of projection of the *Rathakas* (W_n)	
	Pradaksina (Circumambulatory) (P_r)	
	Width of the *Praggriva* (W_{pr}) ***	$W_{pr} = p.W_p = p.n.x$
	Width of the *Jagati* (W_j) ****	$W_j = j.W_p = j.n.x$
Proportionate measures of the Plan of the *Mandapa*	Width of the *Mandapa* (W_m)	
	Depth of the *Mandapa* (D_m)	
	Width of the *Mukhamandapa* (W_{mm})	
Proportionate Vertical measures	Height of *Bhitti* of the *Prasada* (H_b)	$H_b = W_p$
	Height *Jangha* and *Varandika* (H_j & H_v)	
	Height of the *Sikhara* (H_s)	
	Height of the *Sukanasa* (H_{sk})	
	Projection of the *Sukhangiri* (P_{su})	
	Height of the *Vedika* (Vedi) (H_v)	
	Height of the *Griva* and *Amalasaraka* (Hga)	
	Height of the *Jhanga* (H_j)	
	Height of the *Adhistana* (H_a)	
Proportions of the Entrance	Width of the *Dvara* (W_d)	
	Width of the *Udumbara* (W_u)	
	Width of *sakha* (W_{sa})	
	Height of the *dvara* (H_d)	
	Thickness of the *sakha* (T_{sa})	
Height of *prakara*	Height of enclosure wall (H_{pr})	
Proportionate height of the Image or *Linga*	Total height of Image/ *Linga* ($L = H_1 + H_{pe}$)	
	Height of the Image/*Linga* (H_1)	
	Height of the Pedestal (H_{pe})	
Height of the *Prasada*		
	Height of the Prasada (H_p)	$H_p = Hs + H_b$

Table: 2.a

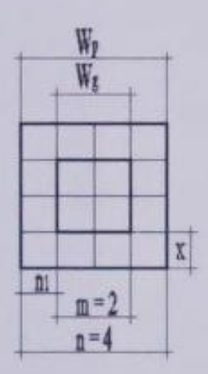
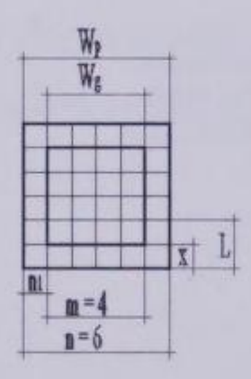
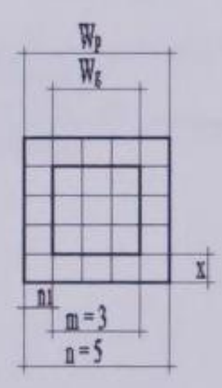
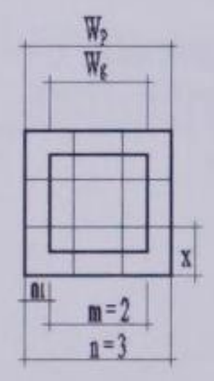
Visvakarmaprakasa, VI, 56-81. Matsya Purana, CCLXIX			
I: sl. 1-6	II:sl. 8-14	III: sl.15-27	IV: sl. 21-27
			
Value of x: x = variable	x = ½ L	x = variable	x = variable
Value of n: n = 4	n = 6	n = 5	n = 3
Value of n_1: $n_1 = 1$	$n_1 = 1$	$n_1 = 1$	$n^1 = ½$
Value of m: m = 2	m = 4	m = 3	m = 2
Value of L :	L = 2.x		
Value of j :			
Value of p : p = 1/10			p = 4/15

Table: 2.b

Module: Width of *Prasada* (W) or *Mulasutra*		Visvakarmaprakasa, VI, 56-81. Matsya Purana, CCLXIX			
		I: sl. 1-6	II:sl. 8-14	III: sl.15-27	IV: sl. 21-27
	Value of x:	x = variable	x = ½ L	x = variable	x = variable
	Value of n:	n = 4	n = 6	n = 5	n = 3
	Value of n_1:	$n_1 = 1$	$n_1 = 1$	$n_1 = 1$	$n^1 = ½$
	Value of m:	m = 2	m = 4	m = 3	m = 2
	Value of L :		L = 2.x		
	Value of j :				
	Value of p :	p = 1/10			p = 4/15
Proportionate measures of the Plan of the *Prasada*	$W_g = Y = X = m.x$	$W_g = 2.x$	$W_g = 4.x = 2.L$	$W_g = 3.x$	$W_g = 2.x$
	$W_p = X = n.x$	$W_p = 4.x$	$W_p = 6.x = 3.L$	$W_p = 5.x$	$W_p = 3.x$
	$T_{pw} = n_1x$	$T_{pw} = ¼ W_p = 1.x$	$T_{pw} = ⅙ W_p = 1.x = ½ L$	$T_{pw} = ⅕ W_p = 1.x$	$T_{pw} = ⅙ W_p = ½ .x$
	A_g (Y x Y = m.x.m.x)	$A_g = 4.x.x$	$A_g = 16.x.x = 4.L.L$	$A_g = 9.x.x$	$A_g = 4.x.x$
	A_p (X x X = n.x . n.x)	$A_p = 16.x.x$	$A_p = 36.x.x = 9.L.L$	$A_p = 25.x.x$	$A_p = 9.x.x$
	$A_{pw} = 4. n_1.x.x (n-n_1)$				
					$W_n = x$
	$W_{pr} = p.W_p = p.n.x$	$W_{pr} = 4/15.n.x = 4/5\ x$			$W_{pr} = 4/15.n.x = 4/5\ x$
	$W_j = j.W_p = j.n.x$				
Proportionate measures of the Plan of the *Mandapa*		$W_m = W_p = 4.x$	$W_m = 2.W_p = 12.x = 6.L$		
		$D_m = W_p = 3.x$			
		$W_{mm} = W_p = 4.x$	$W_{mm} = W_p = 6.x = 3.L$		
Proportionate Vertical measures	$H_b = W_p$	$H_b = W_p = 4.x$	$H_b = W_p = 6.x = 3.L$	$H_b = W_p = 5.x$	$H_b = ⅔ W_p = 2.x$
		$H_s = 2W_p = 8.x$	$H_s = 2W_p = 12.x = 6.L$	$H_s = 2.W_p = 10.x$	$H_s = 4/3 .W_p = 4.x$
			$H_{sk} = ½ W_p = 3.x = 3/2 L$	$H_{sk} = ½ W_p = 5/2\ x$	
			$H_v = ½ W_p = 3.x = 3/2 L$	$H_v = ½ W_p = 5/2\ x$	
			$H_{ga} = ½ W_p = 3.x = 3/2 L$	$H_{ga} = ½ W_p = 5/2\ x$	
Proportions of the Entrance					
Height of *prakara*					
Proportionate height of the Image or *Linga*			L = 2.x		
Height of the *Prasada*	$H_p = H_s + H_b$	$H_p = 3W_p = 12.x$	$H_p = 3W_p = 18.x$	$H_p = 3W_p = 15.x$	$H_p = 2W_p = 6.x$

Table: 3.a

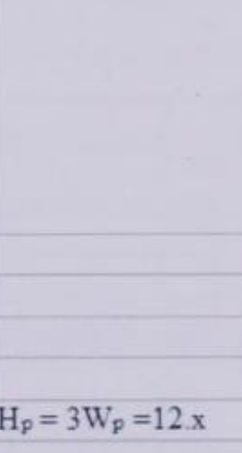
	Brhat Samhita LV	Bhavisya Purana I CXXX		Garuda Purana I XLVII			
	V :sl. 11-16	V: 18-19	I : 19-22	VA : 1-5	I.A. : 6-10	II.A. : 11-13	IV : 17-18
Value of x: Value of n: Value of n_1: Value of m: Value of L : Value of j : Value of p :							

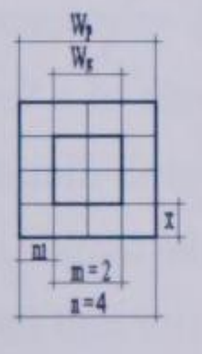
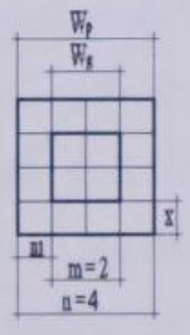
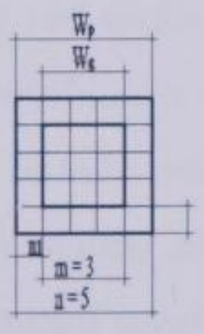
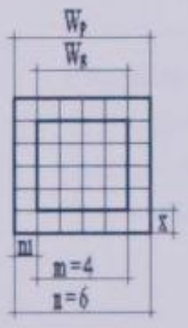
Table: 3.b

Module: Width of *Prasada* (W) or *Mulasutra*		**Brhat Samhita LV**	**Bhavisya Purana I CXXX**	
		V :sl. 11-16	V: 18-19	I : 19-22
	Value of x:			
	Value of n:			
	Value of n_1:			
	Value of m:			
	Value of L :			
	Value of j :			
	Value of p :			
Proportionate measures of the Plan of the *Prasada*	$W_g = Y = X = m.x$	$W_g = 4.x$	$W_g = \frac{1}{2} W_p = 4.x$	$W_g = \frac{1}{2} W_p = 4.x$
	$W_p = X = n.x$	$W_p = 8.x$		
	$T_{pw} = n_1 x$	$T_{pw} = \frac{1}{4} W_p = 2.x$		
	A_g (Y x Y = m.x.m.x)			
	A_p (X x X = n.x . n.x)			
	$A_{pw} = 4. n_1.x.x (n-n_1)$			
	$W_{pr} = p.W_p = p.n.x$			
	$W_j = j.W_p = j.n.x$			
Proportionate measures of the Plan of the *Mandapa*				
Proportionate Vertical measures	$H_b = W_p$			
		$H_j = \frac{2}{3} W_p = \frac{1}{3} H_p$		
Proportions of the Entrance		$W_d = \frac{1}{8} W_p = 1.x$		
		$W_u = \frac{1}{16} Wp = \frac{1}{2}.x$		
		$W_{sa} = \frac{1}{16} W_p = \frac{1}{2}.x$		
		$H_{sa} = \frac{1}{4} W_p = 2.x$		
Height of *prakara*		$H_{pr} = 1/32\ W_p = 1/4.x$		
Proportionate height of the Image or *Linga*		$L = 7/32\ W_p = 7/4.X$		
		$H_1 = 7/48\ W_p = 7/9.X$		
		$H_1 = 7/96\ W_p = 7/12.X$		
Height of the *Prasada*	$H_p = H_s + H_b$	$H_p = 2W_p = 16.x$	$H_p = 2W_p = 16.x$	$H_p = 3W_p = 24.x$

Table: 3.c

Module: Width of *Prasada* (W) or *Mulasutra*		Garuda Purana I XLVII			
		VA : 1-5	I.A. : 6-10	II.A. : 11-13	IV : 17-18
	Value of x:	x = variable	x = variable	x = variable	x = variable
	Value of n:	n = 8	n = 4	n = 4	n = 3
	Value of n_1:	$n_1 = 2$	$n_1 = 1$	$n_1 = 1$	$n_1 = \frac{1}{2}$
	Value of m:	m = 4	m = 2	m = 2	m = 2
	Value of L :			L = 1.x	
	Value of j :				
	Value of p :				$p = \frac{4}{15}$
Proportionate measures of the Plan of the *Prasada*	$W_g = Y = X = m.x$	$W_g = 4.x$	$W_g = 2.x$ (W_g)	$W_g = \frac{1}{2} W_p = 2.x = 2.L$	$W_g = 2.x$
	$W_p = X = n.x$	$W_p = 8.x$	$W_p = 4.x$ (W_p)	$W_p = 1.W_p = 4.x = 4.L$	$W_p = 3.x$
	$T_{pw} = n_1x$		(T_{pw})	$T_{pw} = \frac{1}{4} W_p = 1.x = 1L$	
	A_g (Y x Y = m.x.m.x)		$A_g = 4.x.x$ (A_g)	$A_g = 16.x.x = 4.L.L$	$A_g = 4.x.x$
	A_p (X x X = n.x . n.x)		$A_p = 16.x.x$ (A_p)	$A_p = 36.x.x = 9.L.L$	$A_p = 9.x.x$
	$A_{pw} = 4.n_1.x.x\ (n-n_1)$		(A_{pw})		
			(W_n)		$W_n = \frac{1}{3} W_p = 1.x$
			$P_r = \frac{1}{2} W_p = 2.x$		
	$W_{pr} = p.W_p = p.n.x$				$W_{pr} = \frac{4}{15}.n.x = \frac{4}{5}\ x$
	$W_j = j.W_p = j.n.x$				
Proportionate measures of the Plan of the *Mandapa*					
			$W_{mn} = \frac{1}{4} W_p = 2.x$		
Proportionate Vertical measures	$H_b = W_p$	$H_b = W_p = 8.x$	$H_b = W_p = 4.x$	$H_b = W_p = 4.x = 4.L$	$H_b = \frac{2}{3} W_p = 2.x$
		$H_j = H_v$			
Proportions of the Entrance		$H_s = W_p = 8.x$	$H_s = 2W_p = 8.x$	$H_s = W_p = 4.x = 4.L$	$H_s = \frac{4}{3}.W_p = 4.x$
		$H_{sk} = \frac{1}{2} W_p$ or $\frac{1}{8} W_p$ or $\frac{1}{10} W_p$ = 4.x or $\frac{4}{3}$x or $\frac{4}{5}$x		$H_{sk} = \frac{1}{2} W_p = 2.x = 2.L$	
				$P_{su} = \frac{1}{8} W_p$ or $\frac{1}{10} W_p = \frac{1}{4}.x$ or $\frac{1}{5}.x$	
		$H_v = \frac{1}{4} W_p = 2.x$			
Height of *prakara*		$H_{ga} = \frac{1}{4} W_p = 2.x$			
Proportionate height of the Image or *Linga*				L = 2.x	
Height of the *Prasada*	$H_p = H_s + H_b$	$H_p = 2W_p = 16.x$	$H_p = 3W_p = 12.x$	$H_p = 3W_p = 18.x$	$H_p = 2W_p = 6.x$

Table: 4.a

	Hayasirsa-Pancaratra,ch. III * Agni Purana, ch. XLII **		Agni Purana, ch CIV. 1-11		
	I.A. :1-8	II. B : 9-22	I.	III.	VI.(cf. II)
					
Value of x:	x = variable		x = variable	x = variable	x = variable
Value of n:	n = 4		n = 4	n = 5	n = 6
Value of n_1:	$n_1 = 1$		$n_1 = 1$	$n_1 = 1$	$n_1 = 1$
Value of m:	m = 2		m = 2	m = 3	m = 4
Value of L :					L = 2.x
Value of j :					
Value of p :					

	Hayasirsa-Pancaratra,ch. III * Agni Purana, ch. XLII **		Agni Purana, ch CIV. 1-11		
	I.A. :1-8	II. B : 9-22	I.	III.	VI.(cf. II)
'x' is the dimension of a single grid.	x = variable		x = variable	x = variable	x = variable
'n' is number of the square grids on the *Prasada*.	n = 4		n = 4	n = 5	n = 6
'n1' is number of the square grids of the *Prasada* wall.	$n_1 = 1$		$n_1 = 1$	$n_1 = 1$	$n_1 = 1$
'm' is number of the square grids on the *Garbagriha*.	m = 2		m = 2	m = 3	m = 4
'L' is vertical dimension of the *Linga* + its pedestal.					L = 2.x
	p = 1/10				
Width of the *Grabha Griha* (W_g)	$W_g = 2.x$	$W_g = 2.H_i$	$W_g = 2.x$	$W_g = 3.x$	$W_g = 4.x$
Width of the *Prasada* (W_p)	$W_p = 4.x$	$W_p = 3.H_i$	$W_p = 4.x$	$W_p = 5.x$	$W_p = 6.x$
Thickness of the *Prasada* Wall (T_{pw})	$T_{pw} = 1/4\ W_p = 1.x$	$T_{pw} = 1/6\ W_p = 1/2\ H_i$	$T_{pw} = 1/4\ W_p = 1.x$	$T_{pw} = 1/5\ W_p = 1.x$	$T_{pw} = 1/6\ W_p = 1.x$
Area of the *Garbha Griha* (A_g)	$A_g = 4.x.x$	$A_g = 4.H_i.H_i$	$A_g = 4.x.x$	$A_g = 9.x.x$	$A_g = 16.x.x$
Area of the *Prasada* (A_p)	$A_p = 16.x.x$	$A_p = 9.H_i.H_i$	$A_p = 16.x.x$	$A_p = 25.x.x$	$A_p = 36.x.x$
Area of the *Prasada* walls (A_{pw})					
Nemi, the zone of projection of the *Rathakas* (W_n)			$W_n = 1/2 W_p = 1/4 H_i$	$W_n = 1/4\ W_p = 1.x$	$W_n = 1/5\ W_p = 1.x$	$W_n = 1/6\ W_p = 1.x$
Pradaksina (Circumambulatory) (P_r)	(P_r)	$P_r = 1/2\ W_p = 2.x$	$P_r = 1/2\ W_p = 1/2\ H_i$		
Width of the *Praggriva* (W_{pr}) ***	(W_{pr}) ***	$W_{pr} = 4/15.n.x = 4/5\ x$			
Width of the *Jagati* (W_j) ****	(W_j) ****				
Width of the *Mandapa* (W_m)	(W_m)	$W_m = W_p = 4.x$			
Depth of the *Mandapa* (D_m)	(D_m)	$D_m = 3/4 W_p = 3.x$			
Width of the *Mukhamandapa* (W_{mm})	(W_{mm})	$W_{mm} = W_p = 4.x$	$W_{mm} = 1/2\ W_p = 3.H_i$		
Height of *Bhitti* (Adhisthana, Jangha & Varandika) of the *Prasada* (H_b)	(H_b)	$H_b = W_p = 4.x$	$H_b = W_p = 3.H_i$		
Height *Jangha* and *Varandika* (H_j & H_v)	(H_j & H_v)				
Height of the *Sikhara* (H_s)	(H_s)	$H_s = 2W_p = 8.x$	$H_s = 2W_p = 6.H_i$	H_s is not known	H_s is not known	H_s is not known
Height of the *Sukanasa* (H_{sk})	(H_{sk})		$H_{sk} = W_p = 3.H_i$	$H_{sk} = 1/2\ H_s$	$H_{sk} = 1/2\ H_s$	$H_{sk} = 1/2\ H_s$
Projection of the *Sukhangiri* (P_{su})	(P_{su})				
Height of the *Vedika* (Wall) (H_v)	(H_v)			$H_v = 1/4\ H_s$	$H_v = 1/4\ H_s$	$H_v = 1/4\ H_s$
Height of the *Griva* and *Amalasaraka* (Hga)	(Hga)		$H_{ga} = 1/2\ W_p = 3/2\ H_i$	$H_{ga} = 1/4\ H_s$	$H_{ga} = 1/4\ H_s$	$H_{ga} = 1/4\ H_s$
Height of the *Jhanga* (H_j)	(H_j)		$H_j = 1/2\ W_p = 3/2\ H_i$	$H_j = 1/2 W_p$ or $1/4\ W_p = 2.x$ or $1/2\ x$	$H_j = 1/2 W_p$ or $1/4\ W_p = 1/4\ x$ or $1/2\ x$	$H_j = 1/2 W_p = 1/4\ W_p = 3.x$ or $2.x$
Height of the *Adhistana* (H_a)	(H_a)				
Width of the *Dvara* (W_d)	(W_d)				
Width of the *Udumbara* (W_u)	(W_u)				
Width of *sakha* (W_{sa})	(W_{sa})				$W_{sa} = 1/2\ W_d$	
Height of the *dvara*	(H_d)				$H_d = 1/2\ W_d$	
Thickness of the *sakha*	(T_{sa})		$T_{sa} = 2\ W_d$		
Height of enclosure wall (H_{pr})	(H_{pr})		$H_{pr} = 1/4\ H_p$		$H_{pr} = 2\ W_{sa}$	
Total height of Image/ *Linga* ($L = H_l + H_{ps}$)	($L = H_l + H_{ps}$)		$L = 6/5\ H_l$			
Height of the Image/*Linga* (H_l)	(H_l)		$H_l = 5/6\ L$			
Height of the Pedestal (H_{ps})			$H_{ps} = 1/5\ H_l$			
Height of the Prasada (H_p)	$H_p = 3W_p = 12.x$	$H_p = 3W_p = 19.H_i$	$H_p = 1/4\ W_p$ or $1.W_p$ or $2.W_p$ or $3.W_p$		

Table: 4.b

Computation of Kramrisch charts[15] on 'Proportion study of various elements of a temple structure'

1.5 Square-Circle-Sequence' (SCS): A Design and Geometrical Analysis Method

This study proposes a design and geometrical analysis method, termed 'Square-Circle-Sequence' (SCS). It should not be considered as the only method for designing or analysis but it would definitely help resolve quite a few unresolved questions. Some consideration to the sequence of design and planning of a temple and its complex should be done. For the determination of the overall dimensions of the temple, which would perhaps be an important criteria for the temple design would have been initiated in the beginning after the location of site and its orientation.

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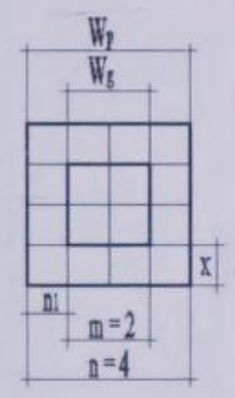
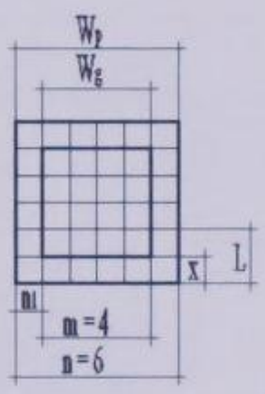
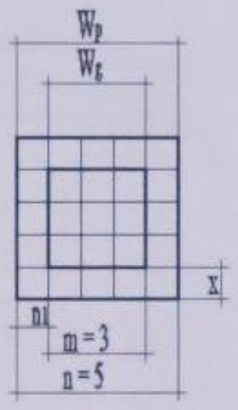
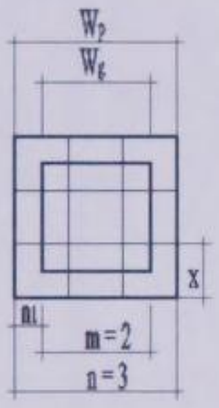
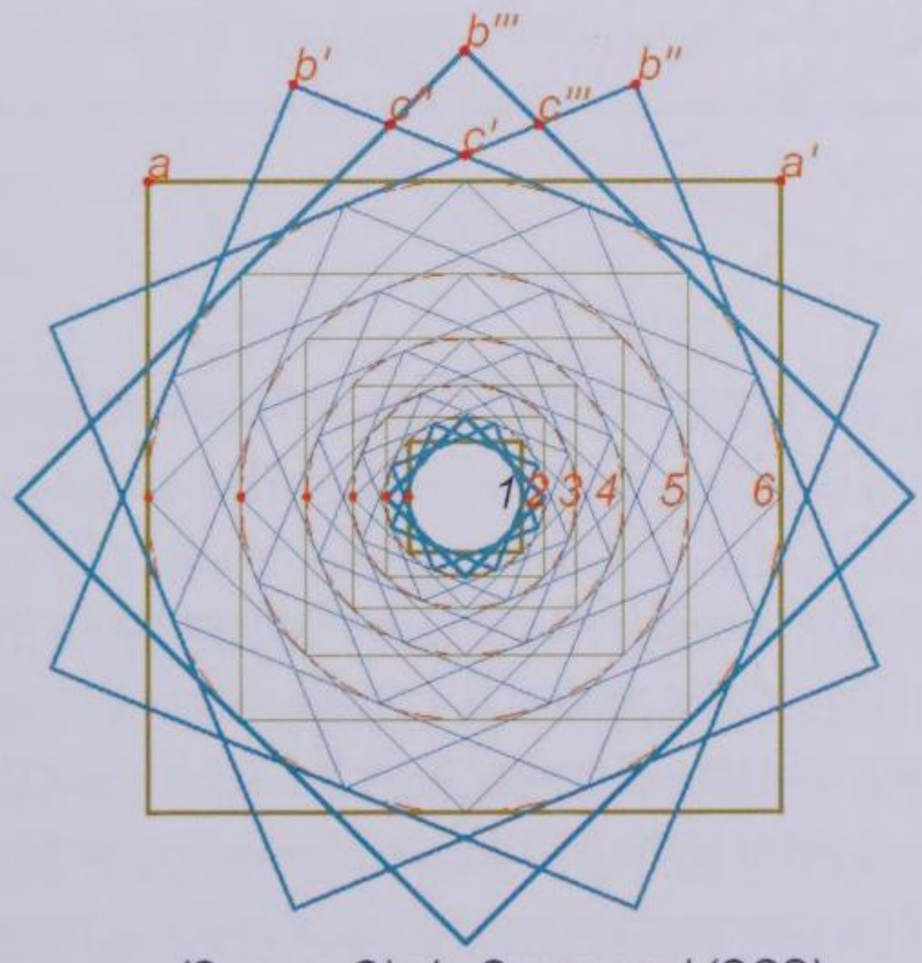
[15] Chart on Proportions of temple's key elements on plan and elevation. Based on Stella Kramrisch, 'Proportionate Measurement and Varieties of the Temple' in *The Hindu Temple* 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996), pp. 227-270.

The 'Ayadi-Sad-Varga' method which is a group of six formulae, as mentioned in the Silpa Shastra could possibly have been used.[16]

	Visvakarmaprakasa, VI, 56-81. Matsya Purana, CCLXIX			
	I: sl. 1-6	II:sl. 8-14	III: sl.15-27	IV: sl. 21-27
				
Value of x:	x = variable	x = ½ L	x = variable	x = variable
Value of n:	n = 4	n = 6	n = 5	n = 3
Value of n_1:	$n_1 = 1$	$n_1 = 1$	$n_1 = 1$	$n^1 = ½$
Value of m:	m = 2	m = 4	m = 3	m = 2
Value of L :		L = 2.x		
Value of j :				
Value of p :	p = 1/10			p = 4/15



'Square-Circle-Sequence' (SCS)

Top to bottom
Figure: 1.2 Chart on Proportions of temple's key elements on plan and elevation. Based on Stella Kramrisch, 'Proportionate Measurement and Varieties of the Temple' in The Hindu Temple 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996), pp. 227-270.

Figure: 1.3 The construction of the proposed analytical and design method termed 'Square-Circle-Sequence' (SCS).

[16] D.N.Shukla, *Vastu-Shastra*, Vol.1, 2 Vols, (New Delhi, Munshiram Manoharlal Publishers Pvt. Ltd., 1998).

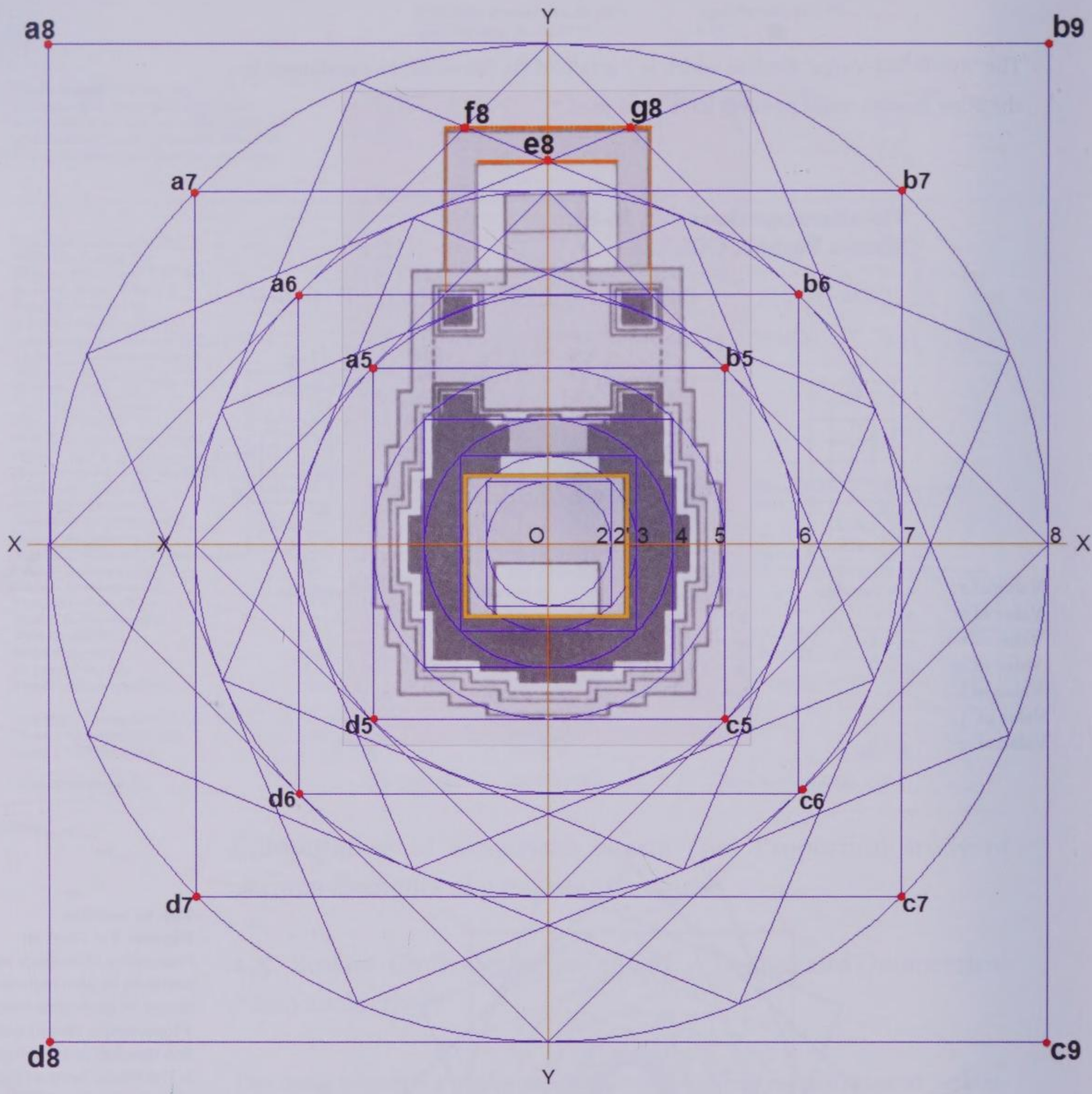


Figure: 1.4 Application of SCS shown for South-west shrine, Kunda-vapi, Dedadara, Gujarat, ca. A.D. 925.

The SCS method as would be shown in this study can generate the main areas as well as smaller details. The method is a simple sequence of square and circles (Fig.1.3). The squares are rotated at 22.5° to form a 16-point star (the 16 points can be equated to the 16 petals of the *Sri Yantra*). Three sets of points are created, the first set consist of the corners of the squares (eg. 'a' and 'a´'), the second are the 16 points of each rotated square (e.g. 'b´', 'b´´' and 'b´´´') and the third set consist of intersection points '*marma*' (e.g. 'c´', 'c´´' and 'c´´´'). The intersection points '*marmas*' of this 16-point figure when projected provide all the key locations of the temple plan. Smaller details can also be derived with exact precision from this

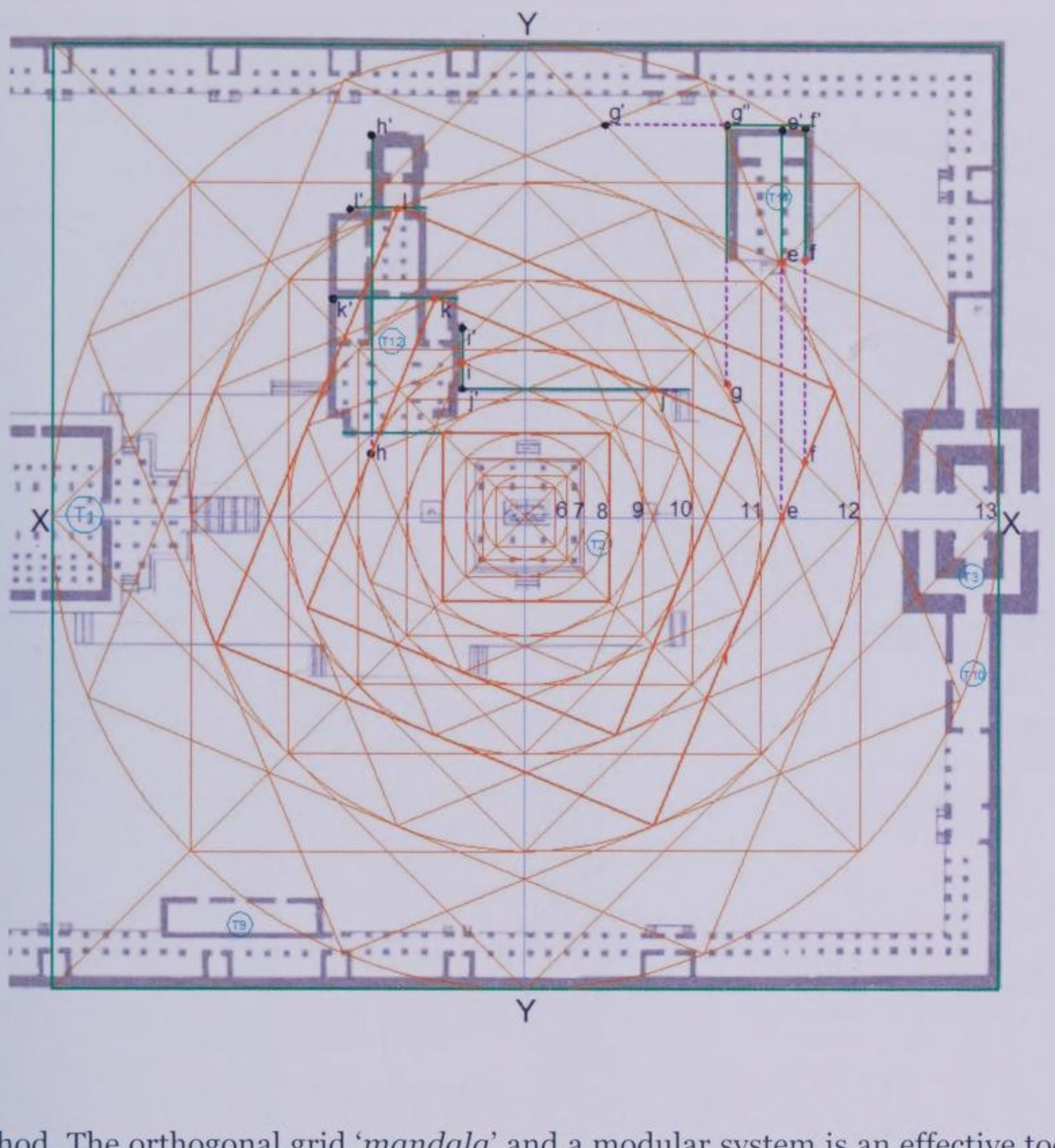


Figure: 1.5 Relationship being established between the nandi-mandapa and the surrounding structures with the application of SCS at Brihadeshwara temple complex, Tanjavur, ca. A.D. eleventh century.

method. The orthogonal grid '*mandala*' and a modular system is an effective tool to analyse the roof plans in coordination with ground plan of the temples. The existing theories which try to explain the parameters for temple design do not offer explanations for quite a few things. Hence, an integrated multi-approach theory would be more apt.

The SCS starts with a square which coincides with the size of the deity and in case where the enshrined figure is a *linga* and its *yoni pitha* the sequence starts with a circle. With the help of numerous examples it can be proved, that if we start the sequence with the dimensions of the deity, then all the key elements coincide with the SCS sequence. The location of the *garbhagriha* is also located with this method. The cases where the *garbhagriha* is off centered or rectangular have also been shown in this study, to be generating from this method (Fig.1.4). We can use this method on various temples to help resolve complex temple layouts. A study on the Brihadeshwara temple complex, Tanjavur, *ca.* A.D. eleventh century, Brahmeshwara temple complex, Bhubaneshwar, Orissa, *ca.* A.D. 1060 and Kunda Vapi, Dedadara, Gujarat, *ca.* A.D. 925, confirms this (Figs.1.5 -1.8). Besides locating the subsidiary shrines, the locations of the peripheral walls and their entrances

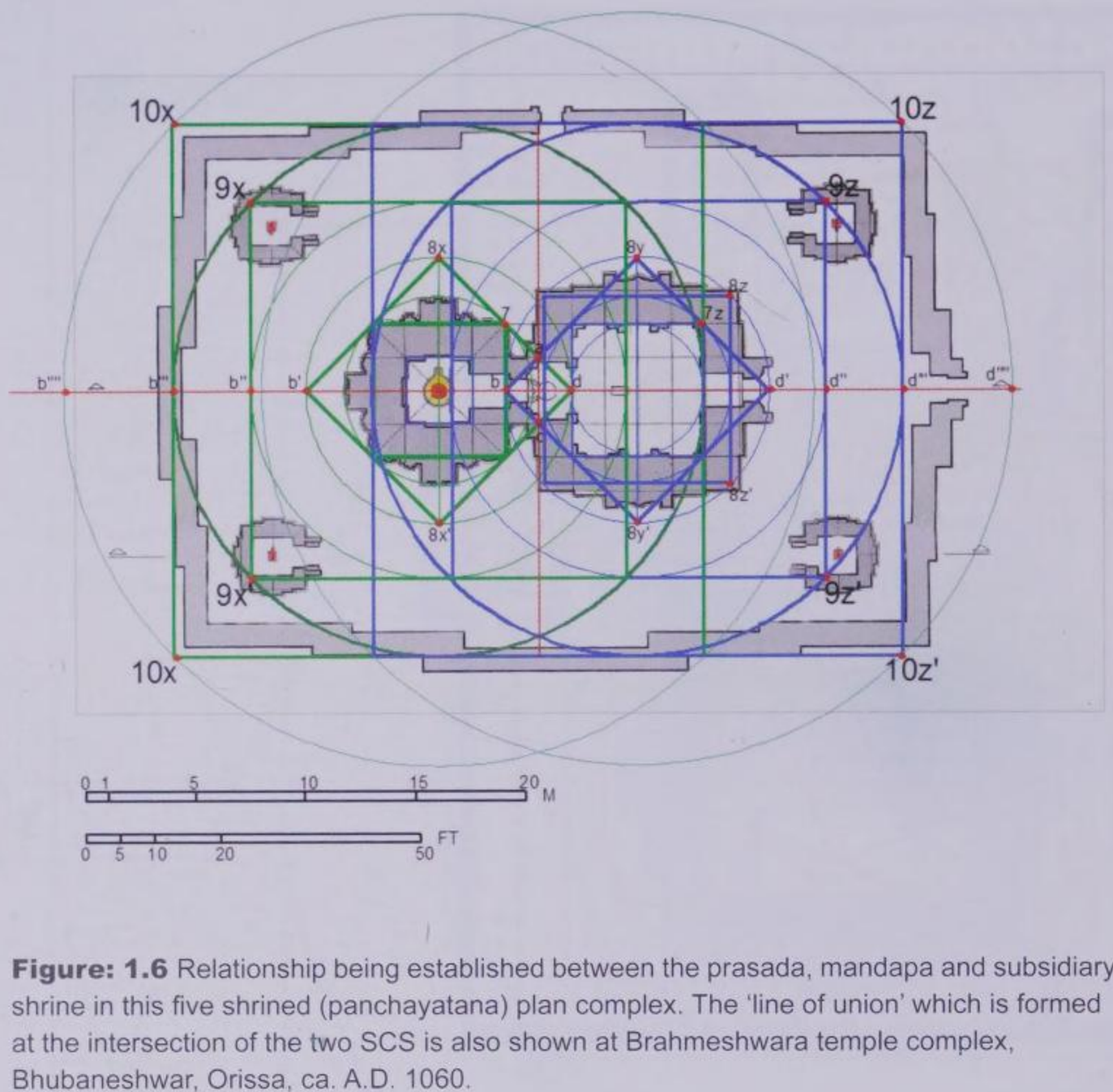


Figure: 1.6 Relationship being established between the prasada, mandapa and subsidiary shrine in this five shrined (panchayatana) plan complex. The 'line of union' which is formed at the intersection of the two SCS is also shown at Brahmeshwara temple complex, Bhubaneshwar, Orissa, ca. A.D. 1060.

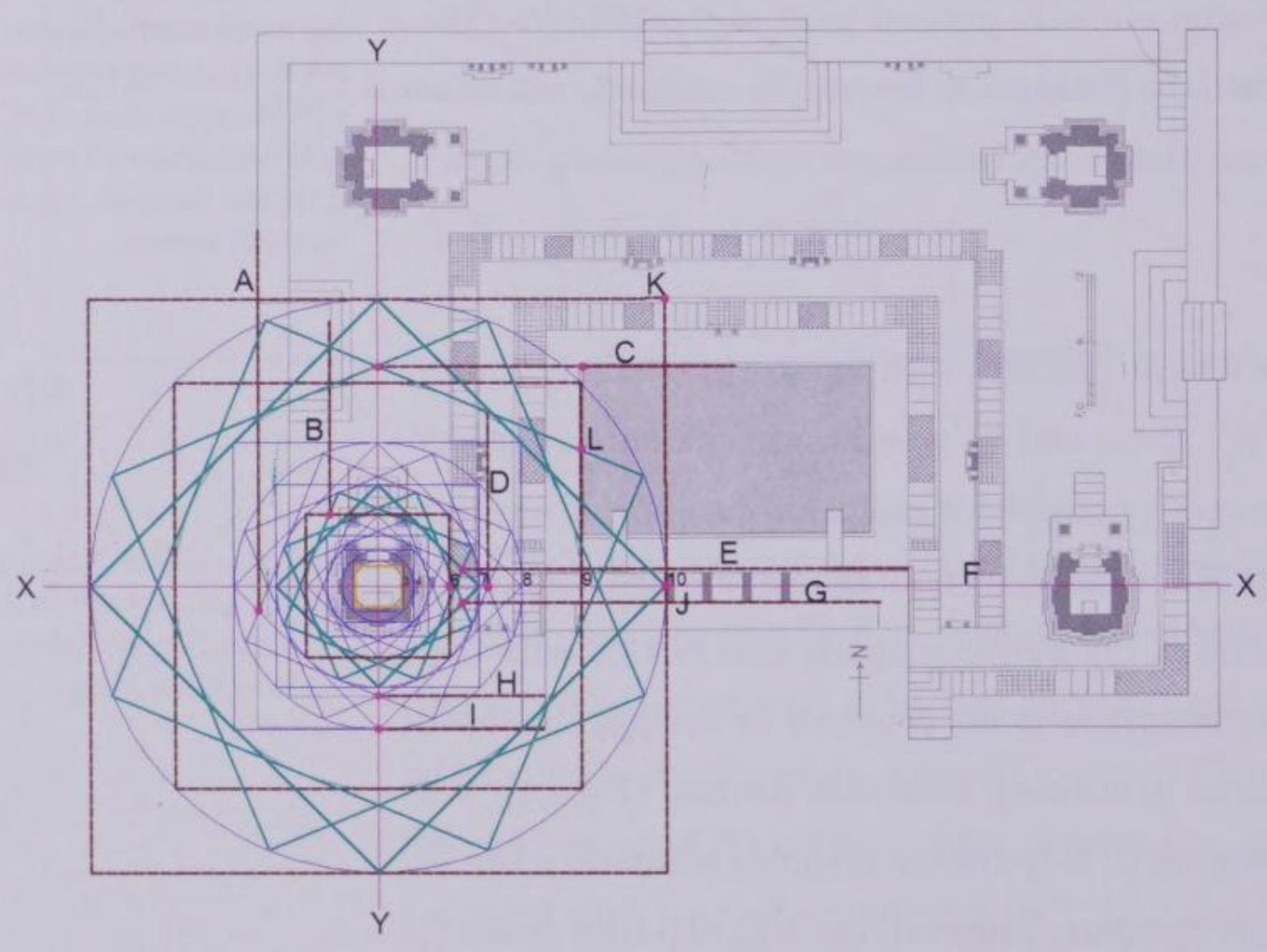


Figure: 1.7 The derivation of the locations of the Kunda and peripheral wall, by the use of projections from the SCS of the South-west shrine, Kunda-vapi, Dedadara, Gujarat, ca. A.D. 925.

Harihara temple no.1, Osian,
Madhya Pradesh 725-750 AD.

From top to bottom
Figure: 1.8 The locations of the subsidiary shrines (devakulikas) in the larger temple complexes can be established with the use of the SCS method. Photograph of panchayatna temple, Jasmalnath Mahadeva, Asoda, Gujarat, ca. A.D. 1126-1150, view from west, (courtesy AIIS)

Figure: 1.9 Location of the offsets and projections in the entrance being derived from the SCS of mandapa. Brahmeshwara temple complex, Bhubaneshwar, Orissa, ca. A.D. 1060.

Figure: 1.10 Analytical drawing of the Sri Yantra showing its intersecting circles. The Sri Yantra, drafted and made suitable for analytical purposes.

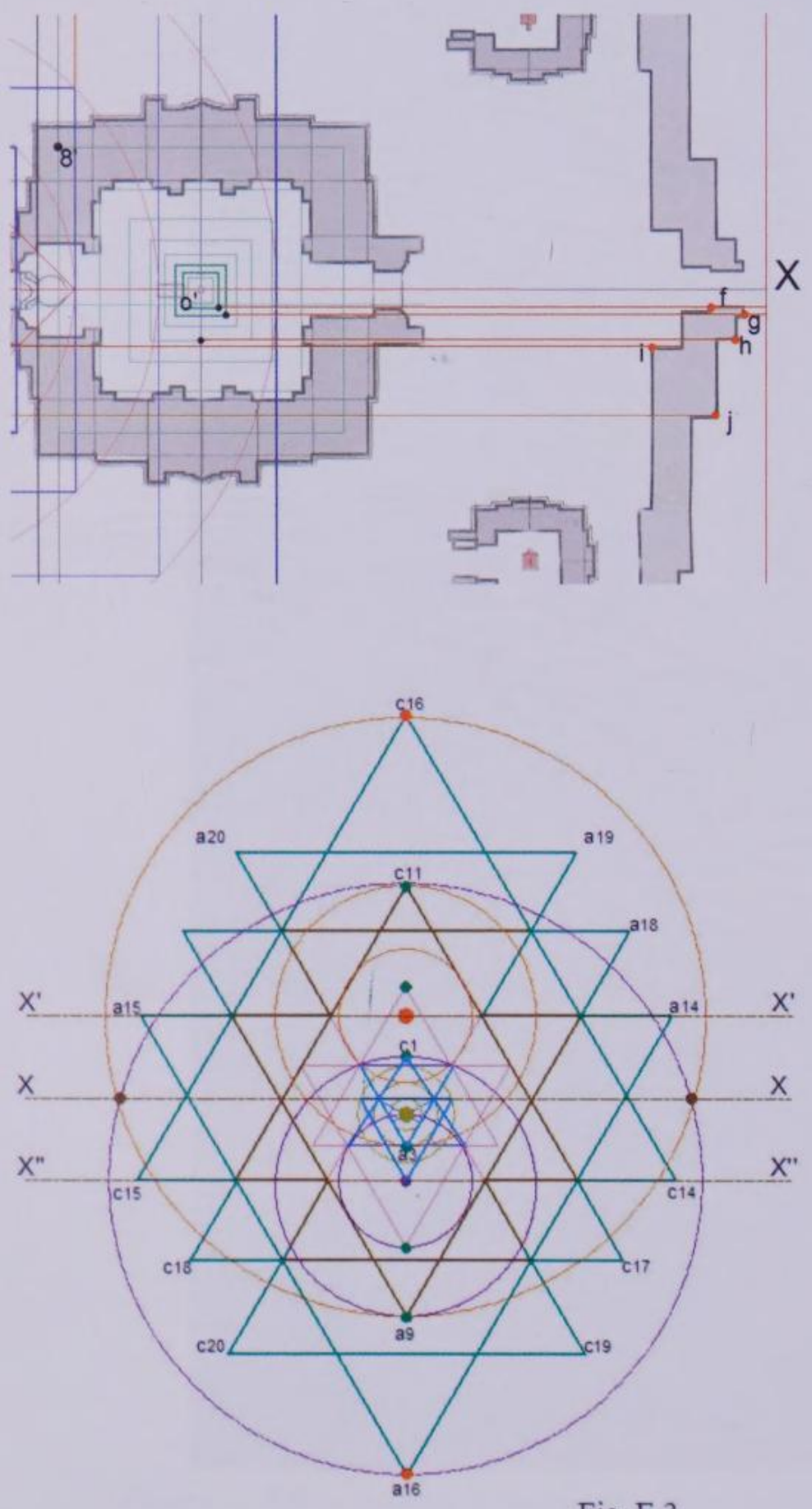


Fig. E.3

can also be done by this method (Fig.1.9). The existing theories and concepts, like the *Mandala*, *Sriyantra* and *diagonal grid* need to be re-evaluated for their effective use in temple design. The published *Sri Yantra* drawings need to be modified to be made fit for direct application on temple plans and elevations (Figs.1.10 -1.11). Further, the study establishes relationship between *Sri Yantra* and temple plan and elevation (Figs.1.12 -1.13). The ancient diagram '*yantra*' usually because of its complex nature has been limited to its role as a device for meditation. Mentions of its application for temple design made me explore the possibility of a higher role in the temple design process. Theories like *vastupurushmandala* which have received a definitive status have been critically analysed. The application of the diagonal grid and key relationships between the temple areas, garbhagriha, *vestibule, mandapa* and transepts as prescribed in *Silpasarini* has been analysed (Figs. 1.14 -1.15) [17]

17 Alice Boner, 'Extracts from the Silpasarini', in *Studies in Indian Temple Architecture*, ed. by Pramod Chandra, (New Delhi, American Institute of Indian Studies, 1975), pp.57-79.

Figure: 1.11 "Sri Yantra, the most celebrated of all the tantric yantras. A mystical construction of the cosmos, the Sri yantra is formed by the interpretation of two sets of triangles, apex upwards, representing the male principle and five, apex downward, representing the female principle. The yantra is devised to give a vision of the totality, so that theadapt may internalize its symbols for the ultimate realization of his unity with the cosmos." [courtesy Madhu Khanna, 'Archetypal Space and Sacred Sound', in Yantra: The Tantric Symbol of Cosmic Unity, 2nd edn (London, Thames and Hudson, 2003), p.113, Fig.62]

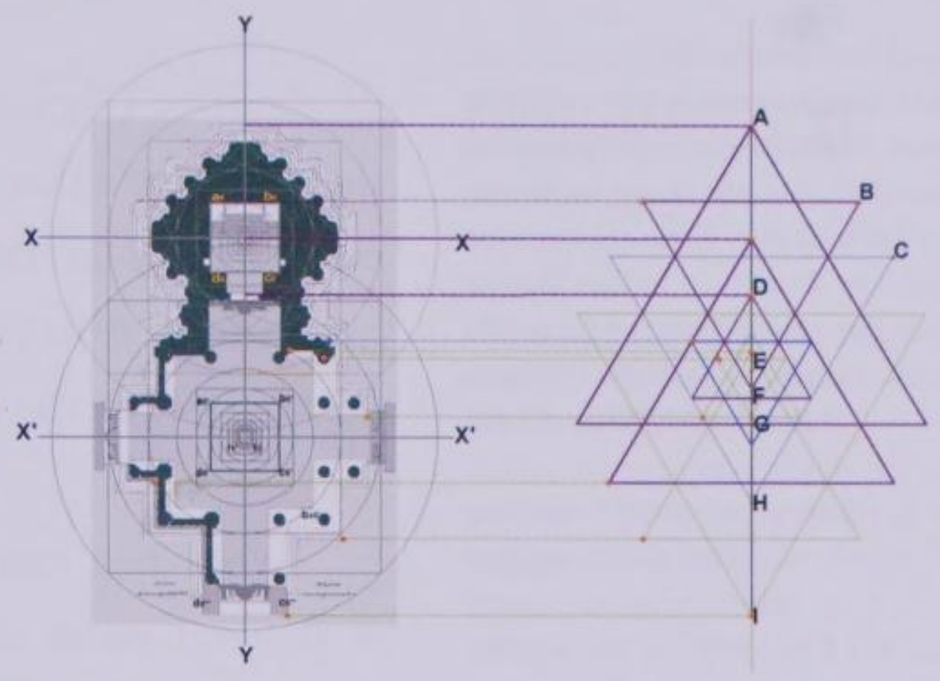


Figure: 1.12 Application of the Sri Yantra on temple plan, Bahu temple, Nagada, Rajasthan ca. A.D. 975-980. Note the locations of the base of the female principle matches with the inner wall of the garbhagriha and the apex of the male principle matches with the centre of the garbhagriha.

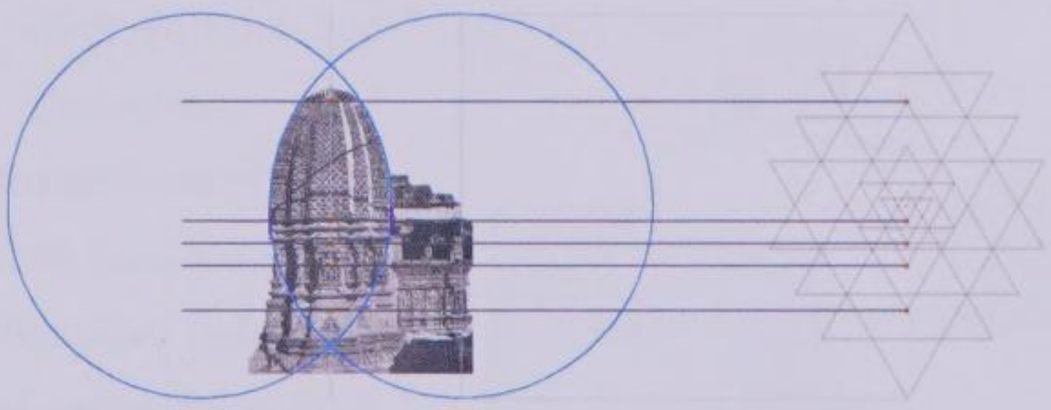


Figure: 1.13 Application of the Sri yantra to the elevation, Vishnu temple, Aithor, Gujarat, c. A.D. early eleventh century.

The 'Square-Circle-Sequence' (SCS) tries to resolve the complex design features like location, proportion and measurement of the temple sub-parts and also establishes the relationship between them. If done manually, the results would have been next to impossible to achieve. The validity of the SCS system can be established by the fact that it can be noted in a few temples that one of the SCS squares can be equated to the area of the temple (Fig.1.16).

Besides this, the elevation which has been studied separately should be read in conjunction with the plan and this has been proved here with the help of SCS. The proportions of any temple's SCS square or circle are reflected in the elevation. The ancient architect could easily use rope or rod to reflect these dimensions of the plan to

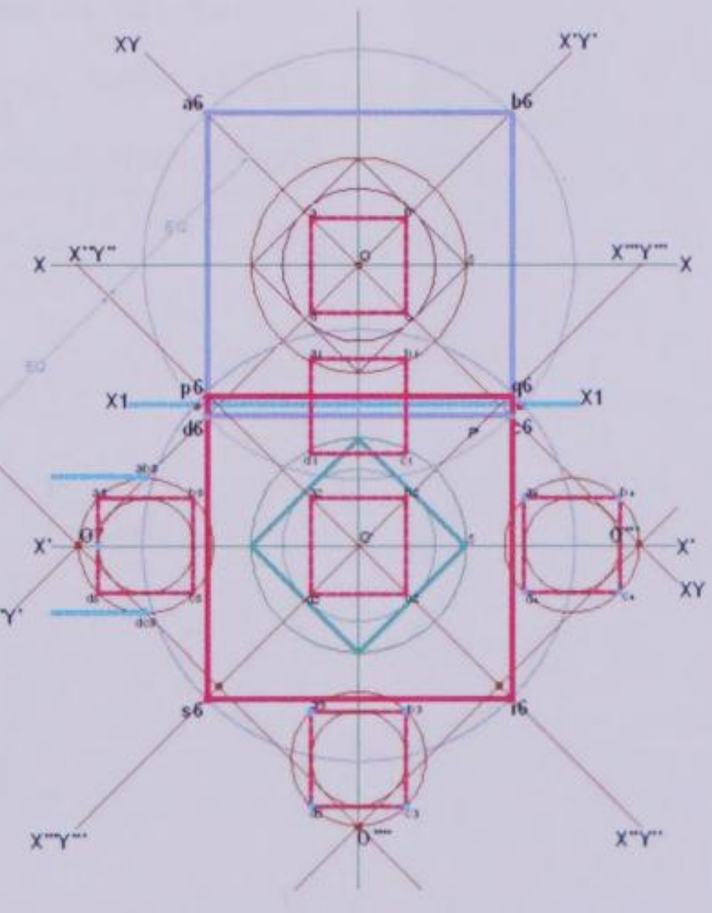


Figure: 1.14 Diagram establishing the relationship between plan elements and showing similar sizes, stellate temple, Jagadamba Devi, Kokamtham, Maharastra, ca. A.D. Fourteenth century.

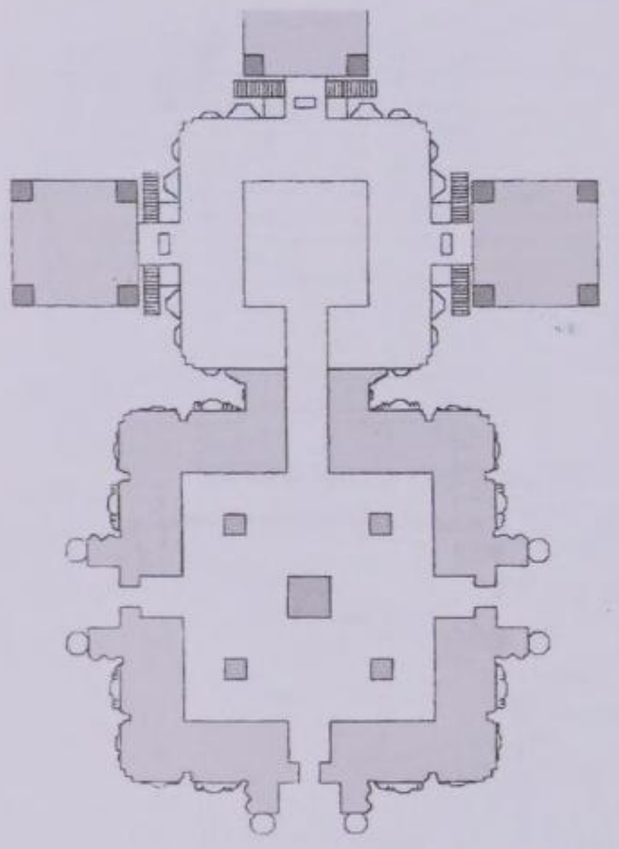
its elevation (Fig.1.17). It should be noted that the circles that are shown in analysis of elevations in this study, implies the proportions of the plan SCS and not actual circle shapes on the elevations.

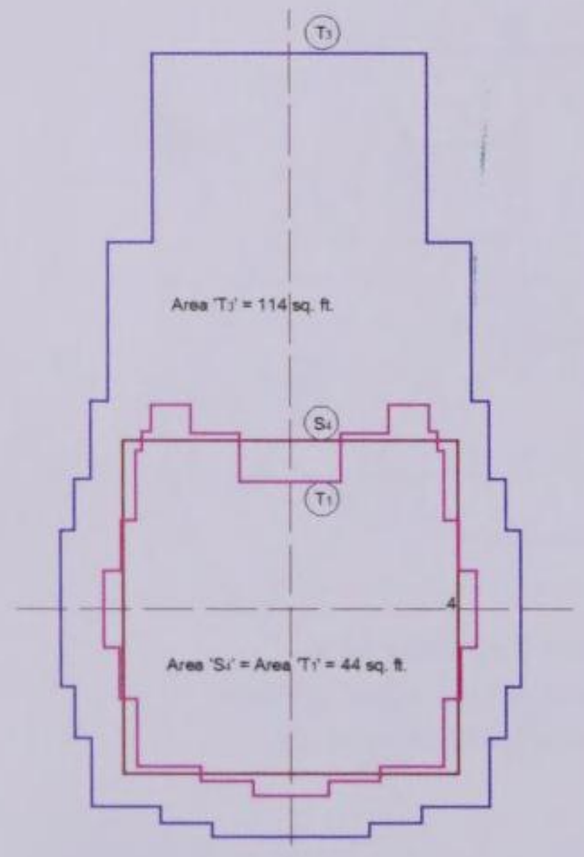
What has finally been shown here is the end result of intense testing and experimentation exercises conducted over various North India temple architecture (*Nagara*) sets. Numerous examples of North Indian single spire form (*Latina*) and multiple spire form (*Shekhari*) have been considered. Although the study focuses on *Nagara* temples of Gujarat, Rajasthan and Madhya Pradesh regions of India, references of some temples having different architectural style and features like octagonal Shiva temple at Mundeshwari, Bihar, ca. early seventh century, Brahmeshwara temple of Orissan *Rekha deul* type from Bhubaneshwar, Orissa, two Stellate temple Chennakeshva,

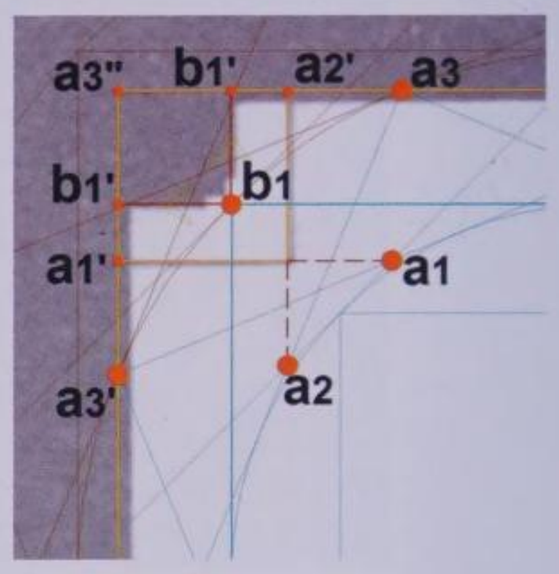
Anti-clockwise from left top
Figure: 1.15 Similar representation of plan elements as shown by Boner, (courtesy Alice Boner, 'Extracts from the Silpasarini', in Studies in Indian Temple Architecture, ed. by Pramod Chandra, (New Delhi, American Institute of Indian Studies, 1975), pp.57-79.

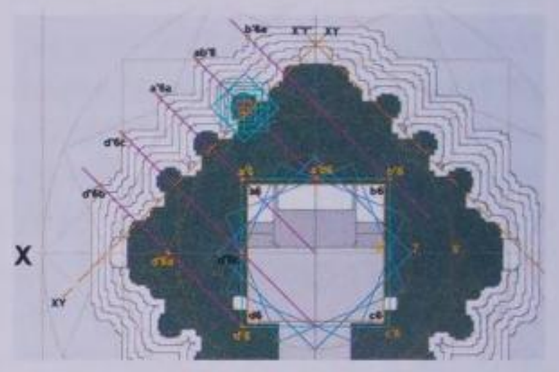
Figure: 1.16 Area of the plan matches the SCS of square.

Figure: 1.17 Proportions of the plan, translated on to the elevation façade. Various levels can be determined through the SCS, Vishnu temple, Aithor, Gujarat, c. A.D. early eleventh.



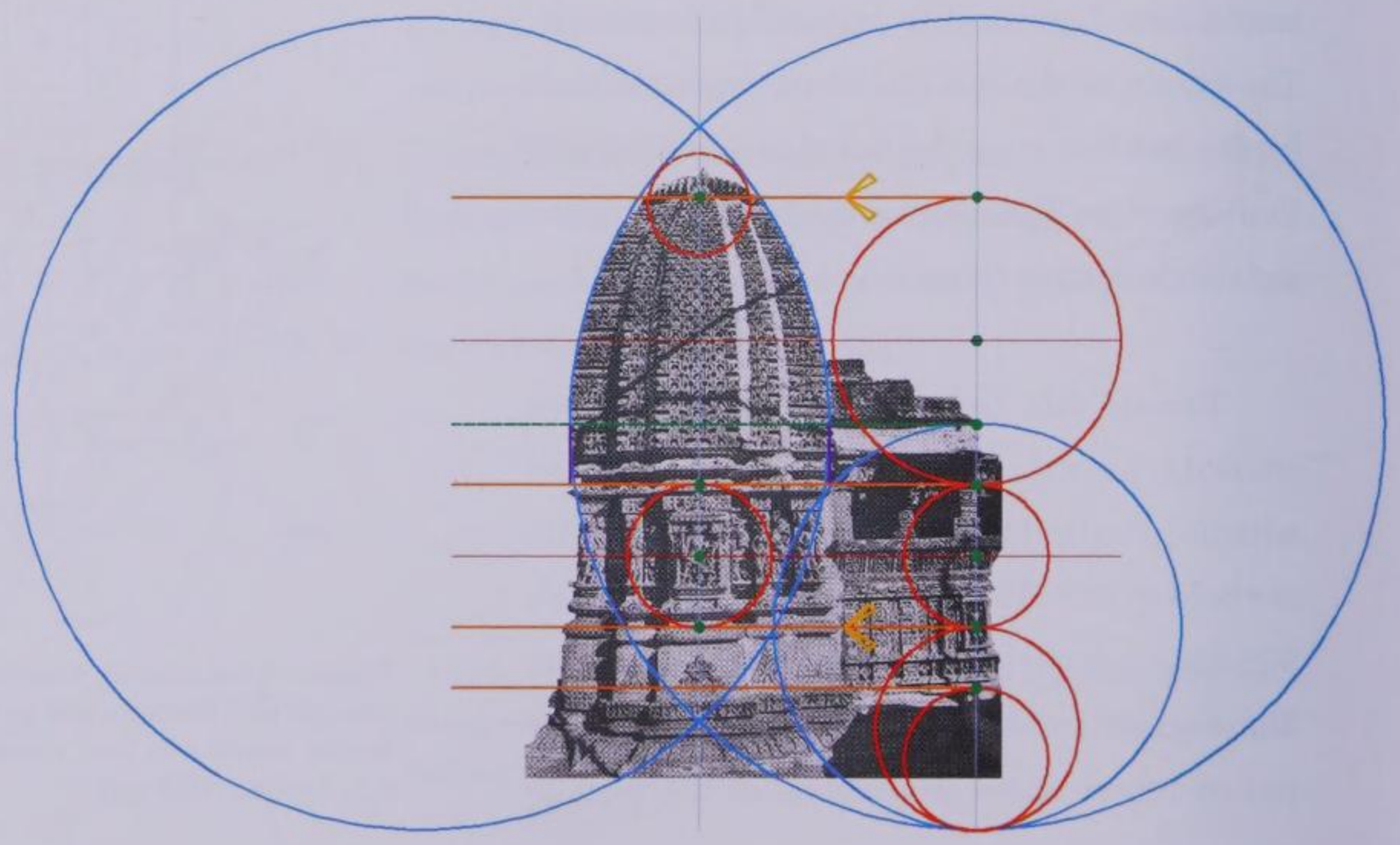






From top to bottom
Figure: 1.18 SCS determining the pillar positions inside the sanctum, Vishnu temple, Batasha, Madhya Pradesh, ca. A.D. tenth century.

Figure: 1.20 The kutastambha being derived from the smallest SC sequence. The diagonal lines of the stambhas match with the garbhagriha corners and center points. Bahu temple, Rajasthan.



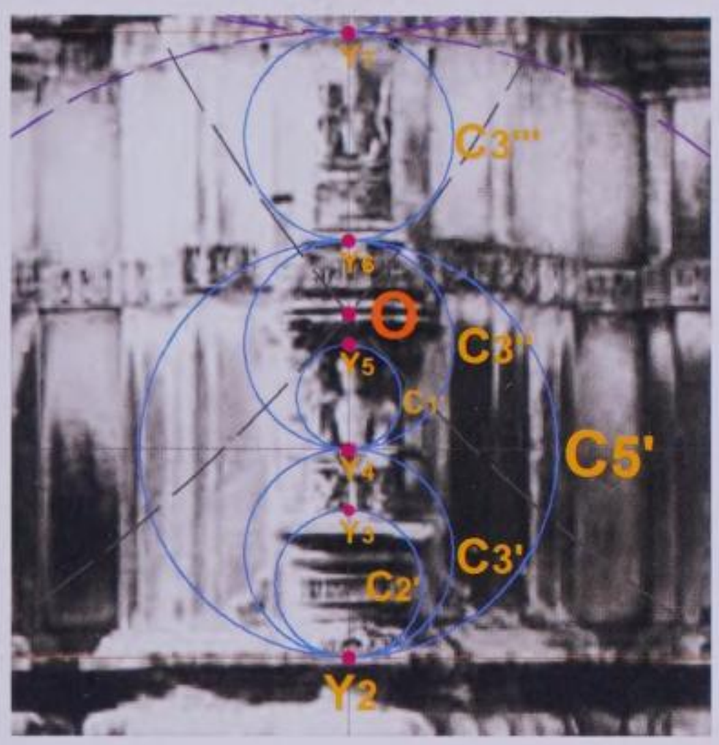


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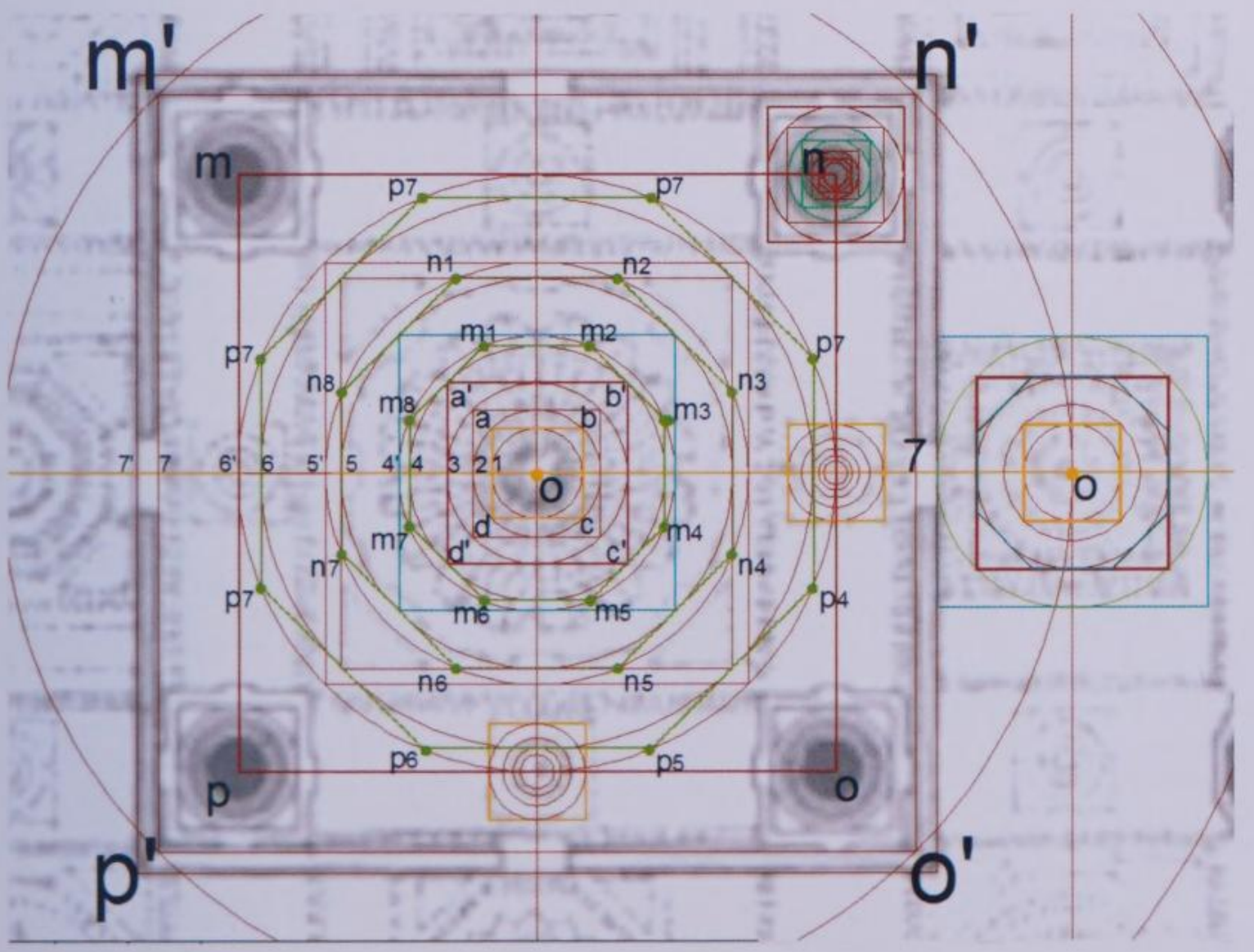
Figure: 1.21 Locations of horizontal divisions on the elevation, Bahu temple, Rajasthan.

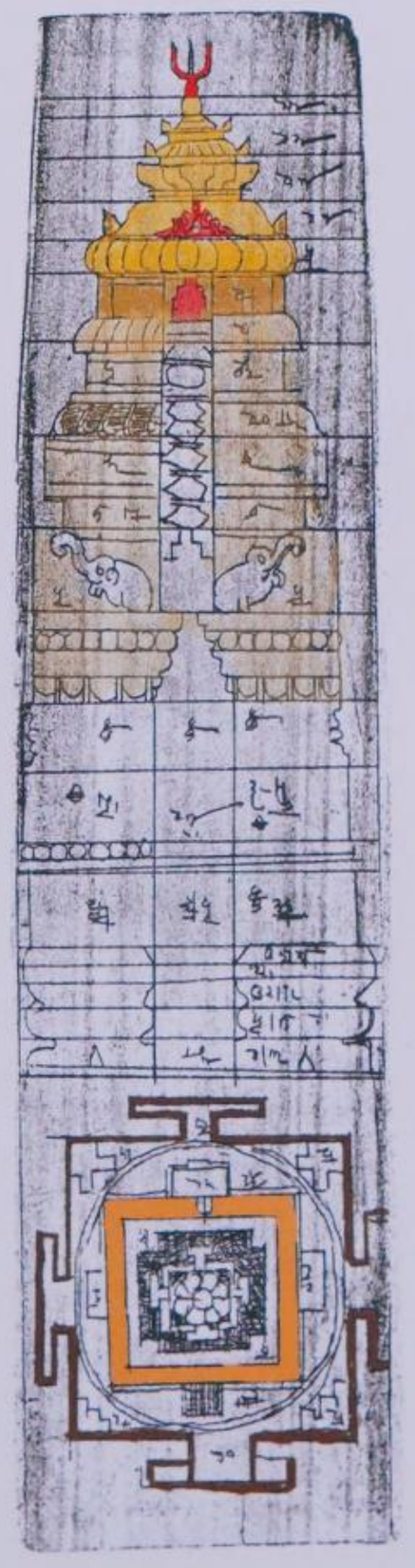
Figure: 1.19 All the inverted ceiling plans being worked out from SCS. The shift is visible in the ceiling which is created by an inscribed octagon, Chennakesva temple, Nagalpura, Karnataka, ca. A.D. 1200.

Figure: 1.22 Palm leaf inscriptions showing the prasada and the yantra, date not known (courtesy Andreas Volwahesen, Living Architecture: Indian, (New York, Grosset & Dunlap, 1969), p.54.

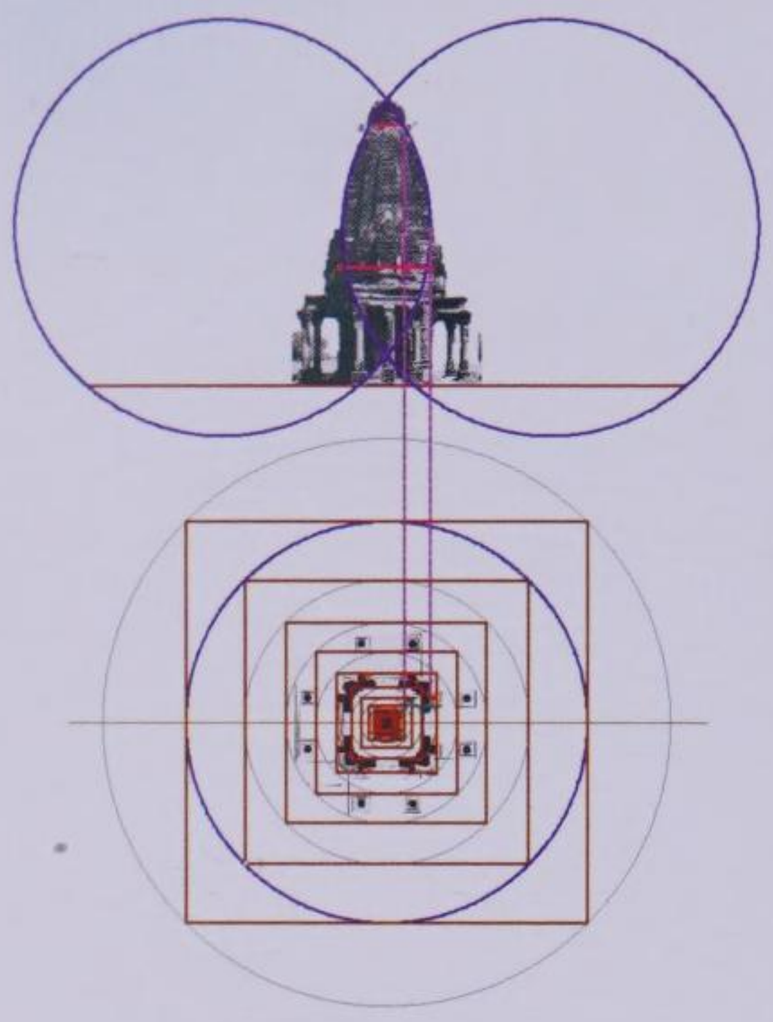
Nagalpura, Tumkur district, Karnataka, *ca.* A.D.1200 and Jagadamba Devi, Kokamtham, Maharashtra, ca. A.D. fourteenth century have also been considered.

The proposed 'Square-Circle-Sequence' can successfully establish details like of the projecting pillar inside the *garbhagriha* (Fig. 1.18), define the geometry of the inverted ceiling plans in *mandapa* (Fig. 1.19), details of '*karnastambhas*' columns of the *prasada* (fig. 1.20) and sculptural and elevation details (Fig. 1.21).





Udeshvara temple, Udayapur, Madhya Pradesh

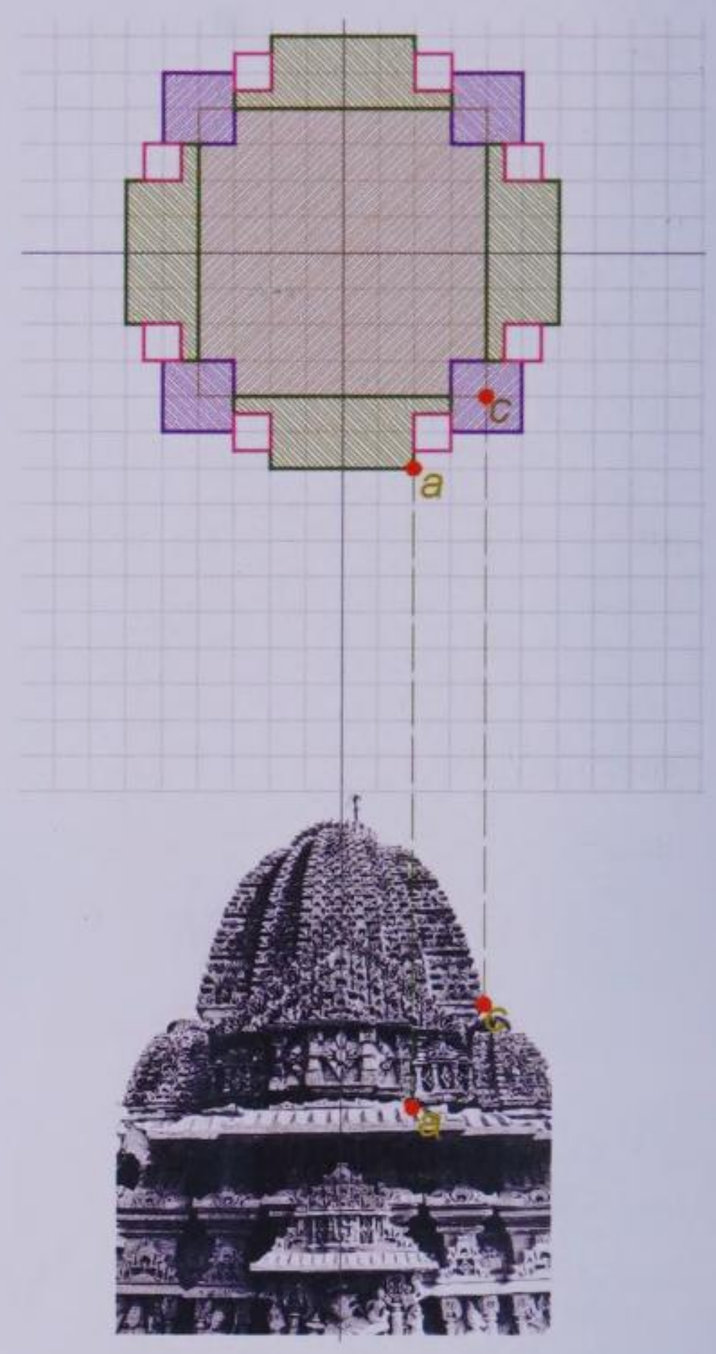


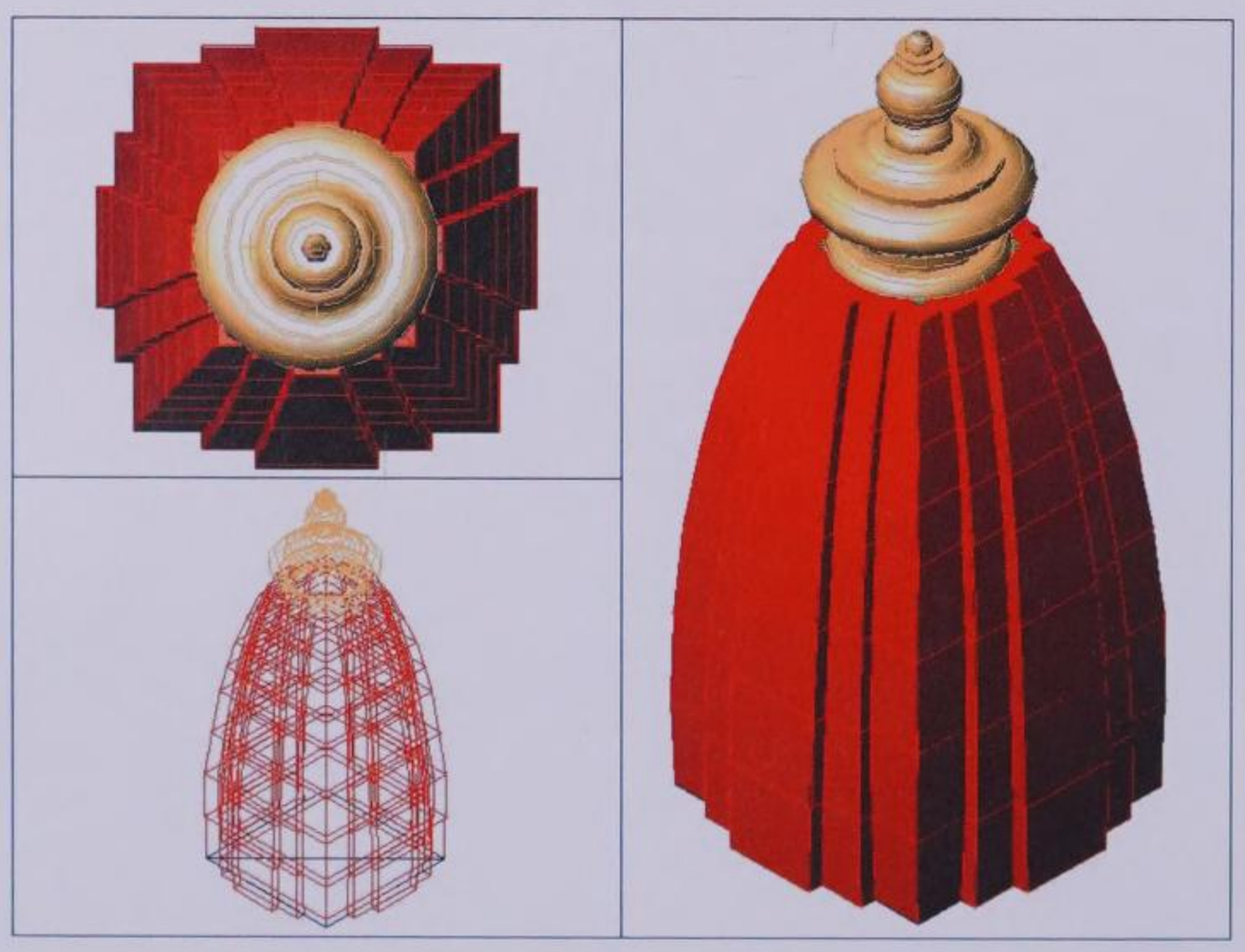
Clockwise from left top
Figure: 1.23 The curvature of the temple being derived from the plan. Location of the base and shoulder course (skandha) of the spire is related to the plan proportions. Jaina temple, Baunpur, Madhya Pradesh, ca. A.D. 900-925.

Figure: 1.24 Roof plan being generated with the help of plan and elevation. Eastern Devakulika, Sacciyamata temple, Osian, ca. A.D. 1178.

Figure: 1.25 Projections from the elevation and a use of a grid are helpful in creating complex 'Shekhari' temple plans. Ambika temple, Jagat, Udaipur, Rajasthan, ca. A.D. 961.

Figure: 1.26 Computer modelling of Sringa

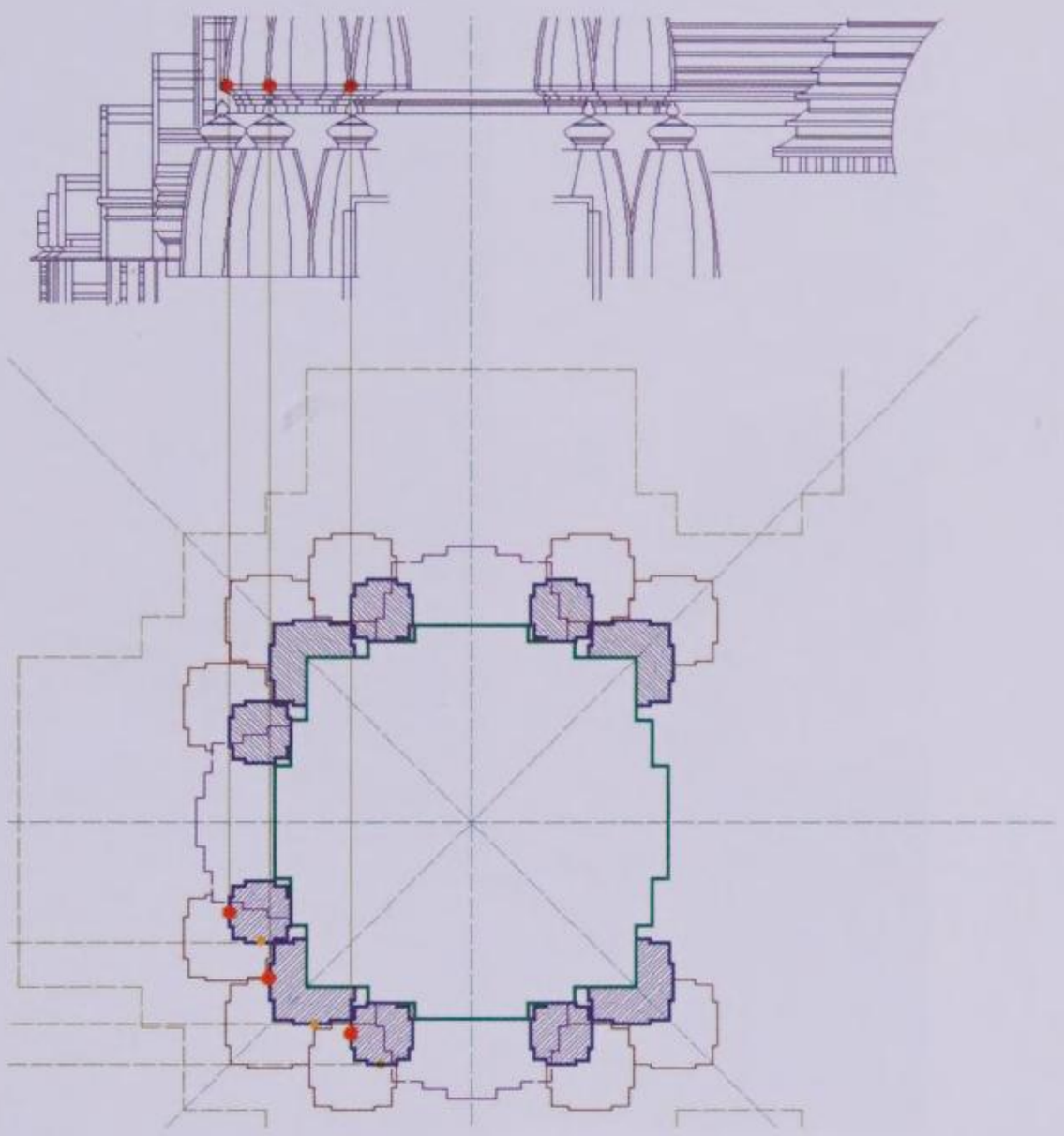




Besides being able to generate precise plans and elevations computers can be an effective medium to combine these two principle design elements to generate correct scaled roof plans. This essential element of the temple study has mostly been left out by scholars because of the obvious difficulties faced during manual drawing. Superimposition of plan to elevation along with interpretation and visualization is required to generate roof plans of existing temples.

In the Fig. 1.23 we can note the plan being drawn in conjunction with its elevation. Hence, there is a probability that the ancient architect could have adopted this technique. This process has been elaborated, in the chapter on 'Roof plans' of *Shekhari* type which represent the highest degree of complexity in Indian temple forms (Figs. 1.24 -1.25) Since computer operations are command based; hence enhanced computer skills would be necessary for its in-depth application in a research study of this nature. A brief tutorial on the application of raster programs is included in the study but description of computer skills related to Computer Aided Design programs are beyond the scope of this study.

Other applications which has been demonstrated in this study is the conversion of existing scaled drawings into dimensioned ones as has been shown for Brihadeshwara temple complex. A form based study of the



From top to bottom
Figure: 1.27 Location of the spirelets (sringas), Roof plan of Lakshmana temple, Khajuraho

Figure: 1.28 Roof plan of Kandhariya Mahadeva temple, Khajuraho, Madhya Pradesh, ca. A.D. 1030.

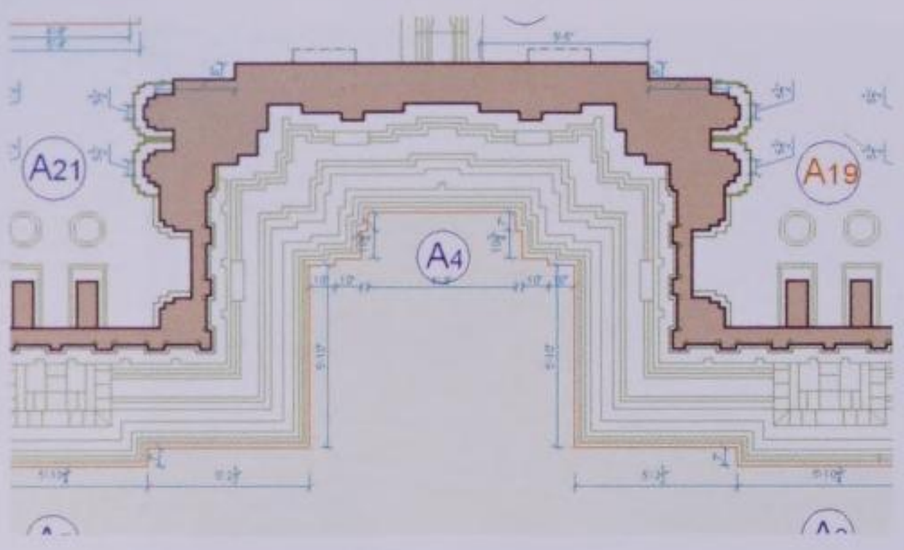
Left Siva temple, Group 5, Kadwaha, Madhya Pradesh

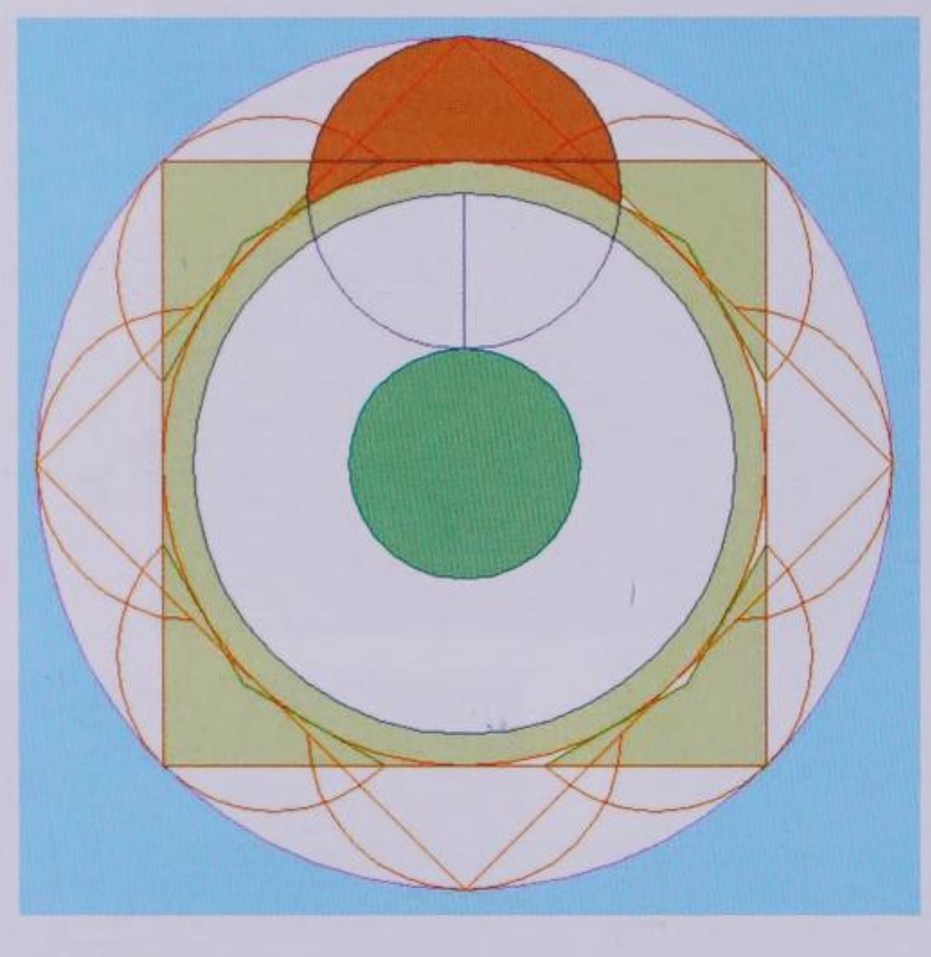
Right Kumbha, Gwalior Museum, Madhya Pradesh

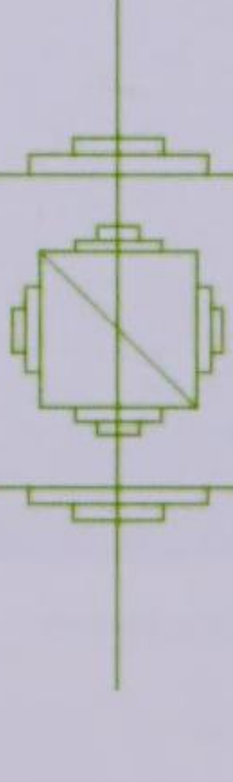
temple structure can not be effectively conducted if its key components are not addressed independently. Independent 3-dimensional models of the sub-parts of the complete temple structure or its roof form can then be assembled to form a whole. This method has been demonstrated for the study on Lakshmana and Kandhariya Mahadeva temples of Khajuraho. The roof plans of both these evolved Shekhari temples have been developed besides the measured drawings of both the temple plan at the *pitha* level. The vast applications of computers for an ancient architecture study are demonstrated below. Ranging from analysis it can be used for documentation, roof plans, modeling and form study exercises, (Figs. 1.26 -1.40).

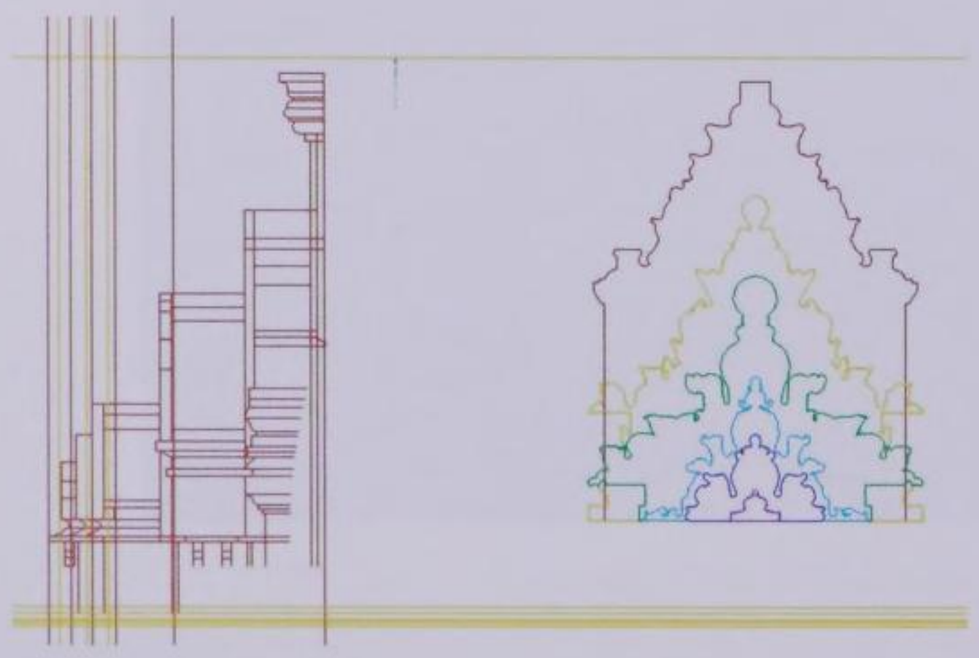
Valabhi temple, Naresar, Madhya Pradesh

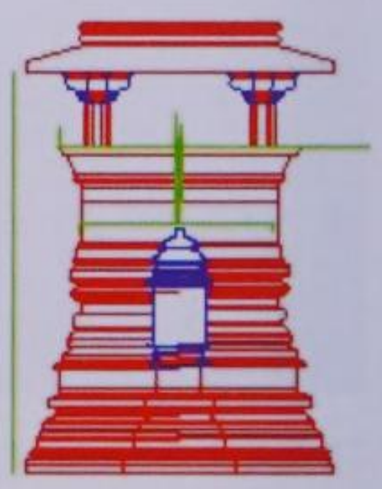
Chaitya window detail, Nasera, Madhya Pradesh











Anti-clockwise from left top

Figure: 1.29 Detailed measured drawings are another application of computer in Ancient Architecture Studies, Measured drawing of Lakshmana temple, Khajuraho included in this study.

Figure: 1.30 Development of the inverted ceiling plan of Mahamandapa using computers. Kandhariya Mahadeva temple, Khajuraho.

Figure: 1.31 Model of the crowning member, left: top view, right: 3-D model. Lakshmana temple, Khajuraho, prasada.

Figure: 1.32 The 3-D model will consist of individual development of sub-parts. Development of 'udgama', Lakshmana temple, Khajuraho.

Figure: 1.33 Model development of temple transepts, Lakshmana temple, Khajuraho

Clockwise from left top

Figure: 1.34 The model of the principal spire form, Lakshmana temple, Khajuraho.

Figure: 1.35 The model of the cluster of spires will involve individual scaled models of the principal spire and its smaller components, Development of the prasada roof form for Lakshmana temple, Khajuraho

Figure: 1.36 Assembly of subparts of the model. Showing spire and siprelet locations in 3 – Dimensional space, transepts of the temple prasada in correct locations, for Lakshmana temple, Khajuraho.

Figure: 1.37 Part 3-D model of the prasada, Lakshmana temple, Khajuraho.

While looking for solutions and deriving a possible method, the ancient architects would have successfully used, a few general things should be kept in mind. Since there is a large degree of complexity and intricate dimensioning and proportioning involved, hence the proposed system should be able support it. The grid is a general layout tool and fails to deliver the geometrical and constructional detail of a temple structure.

Top Ceiling detail, Surwaya, Madhya Pradesh

Previous Page Ceiling detail, Siva temple, Group 6, Kadwaha, Madhya Pradesh

The proposed system derived should address the composite form of the temple and not just its plan. Therefore, it should be applicable for the plan; elevation as well as the roof plan of the temple. The system should have roots in the *vedic* ancient religion and therefore rise above regional architecture and stylistic variations. It should therefore, be able to address the concept of the temple irrespective of its external form. The practicalities of design and construction should be taken into considerations while representing the temple as an architectural structure, which unifies it with the cosmic, metaphysical and Hindu Polytheism theories.

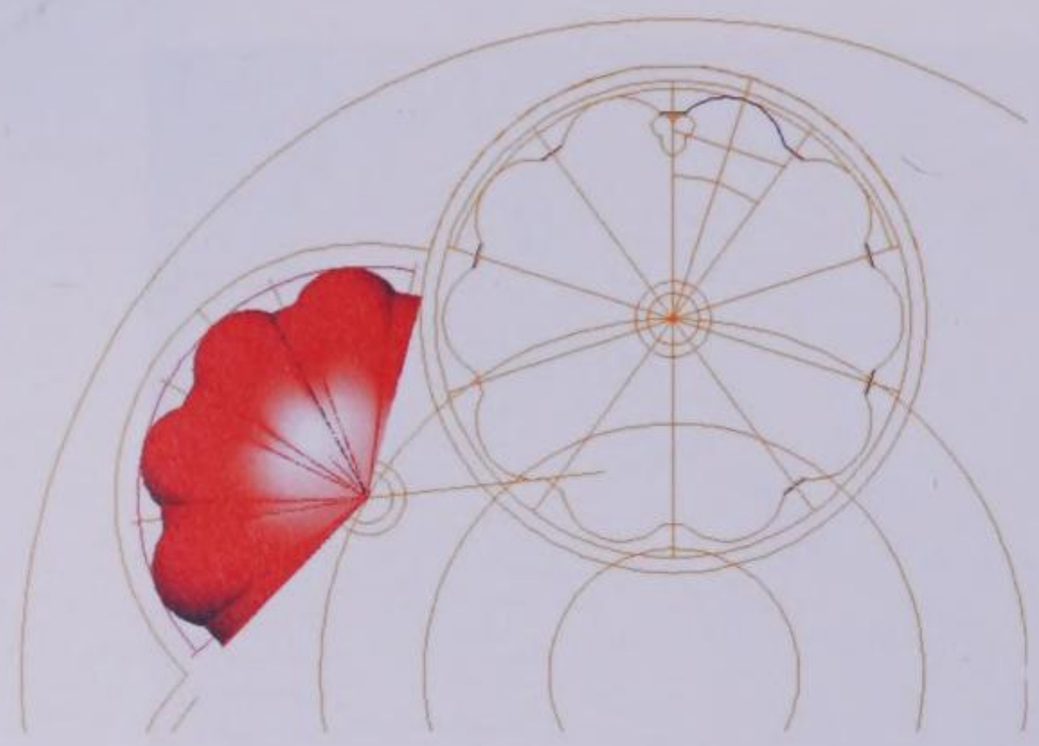


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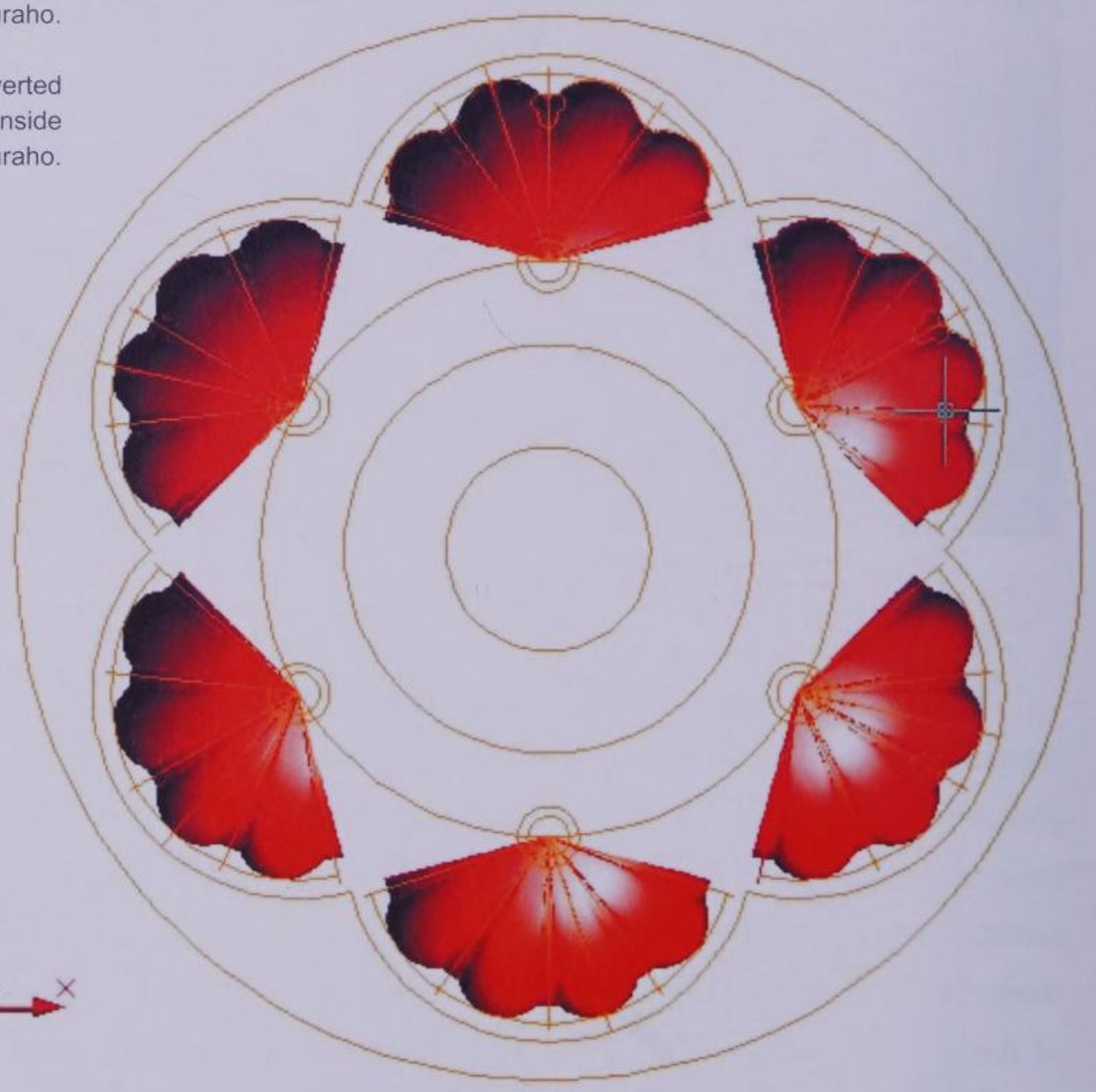
Figure: 1.38 Computer a useful tool to study the complex forms of the inverted ceiling of the temples, Part top view with working drawing, Lakshmana temple, Khajuraho.

Figure: 1.39 Inverted ceiling of the temples, part inside view, Lakshmana temple, Khajuraho.

Figure: 1.40 Top view, Inverted ceiling of the temples, part inside view, Lakshmana temple, Khajuraho.

This method draws comparisons with the existing work of similar type and can be proved to be better because it adopts a flexible approach which can support modifications and variation both in plan and form of a temple structure.



Mamleshwara temple,
Omkareshwara, Madhya Pradesh

2-Analysis of Symbolism

2.1 The 'Vastupurushmandala' Concept

A symbolic diagram termed by Kramrisch as '*vastupurushmandala*', combines the diagram (*mandala*) prescribed for the sites in the ancient texts and the spirit of the site (*Vastupurusha*) (Fig.2.1). This conceptual diagram developed into a definitive governing device for temples and all the other types of Hindu architectural design and planning works.[1]Kramrisch linked the concept of the *Vastupurusa* to that of *Purusa* (the Supernal Man, according to Kramrisch) of the Brahmanical literature, and then further linked it to the creation legend of Prajapati (the demiurge). The diagrams (*mandalas*) for the site have been shown by Acharya (drawn by R.L.Bansal), along with the translations of the original Sanskrit text of *Manasara*[2], Dagens translation of the *Mayamata* too gives the *mandalas* relating to the *vastu* of the site.[3]. There are separate mentions of *purusha*[4], *vastu*[5], *mandala*[6] and *vastupurusha*[7] (whereas, the *vastupurusha* is described as being crooked, hump-backed, and lying face down with his body contorted into the shape of square,[8] *purusha* is any man) in the ancient texts, but strangely there is no mention of the combined term *vastupurushamandala*.

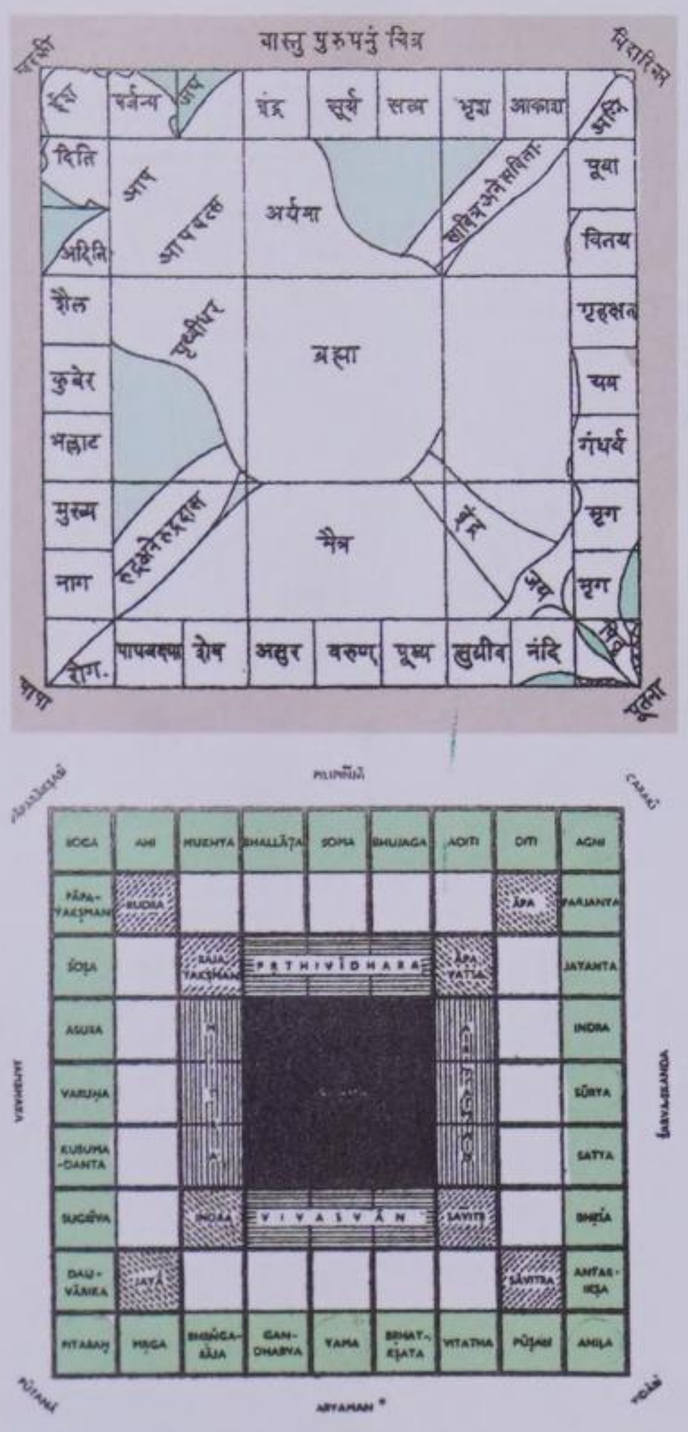


Figure 2.1 Top: *Vastupurusha* in the *Mandala*, Bottom: *Vastu Mandala*

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[1] Ibid.

[2] Prasanna Kumar Acharya transl., 'The Ground Plans', in *Architecture of Manasara*, *Manasara Series, Vol. IV,* (New Delhi, Munshiram Manoharlal Publishers Pvt. Ltd., 1994), First edn. 1934, pp.33-57. For the diagrams see, Prasanna Kumar Acharya transl., *Architecture of Manasara: Illustrations of Architectural and Sculptural Objects*, *Manasara Series, Vol. V,* (New Delhi, Munshiram Manoharlal Publishers Pvt. Ltd., 1995), First edn. 1934, plates.III-XIV.

[3] Bruno Dagens transl., 'Diagrams', in *Mayamata*, (New Delhi, Sitaram Bhartia Institute of Science and Research, 1995), 2 edns., first ed. 1985, pp. 14-24.

[4] Norman W. Brown transl., *Rigveda, X.90.5*, , JAOS, vol.51, p.116

[5] See, Manasara and Mayamatam.

[6] Mentions, acc. to Kramrisch, vol.1, pp.86-8 there in Vishvakarmaprakasa , Matsyapurana, Brahat Samhita, Isanasivagurudevapaddhati, Kamikagama, Samarangasutradhara, Silparatna and Vishvakarmavidhyaprakasa.

[7] Matsyapurana, ch.226; Pauranikavastusantiprayoga,Fol.25

[8] Sonit Bafna, 'On the Idea of the Mandala as a Governing Device in Indian Architectural Tradition', in JSAH / 59:1, (March,2000), pp. 26-49, (p.29).

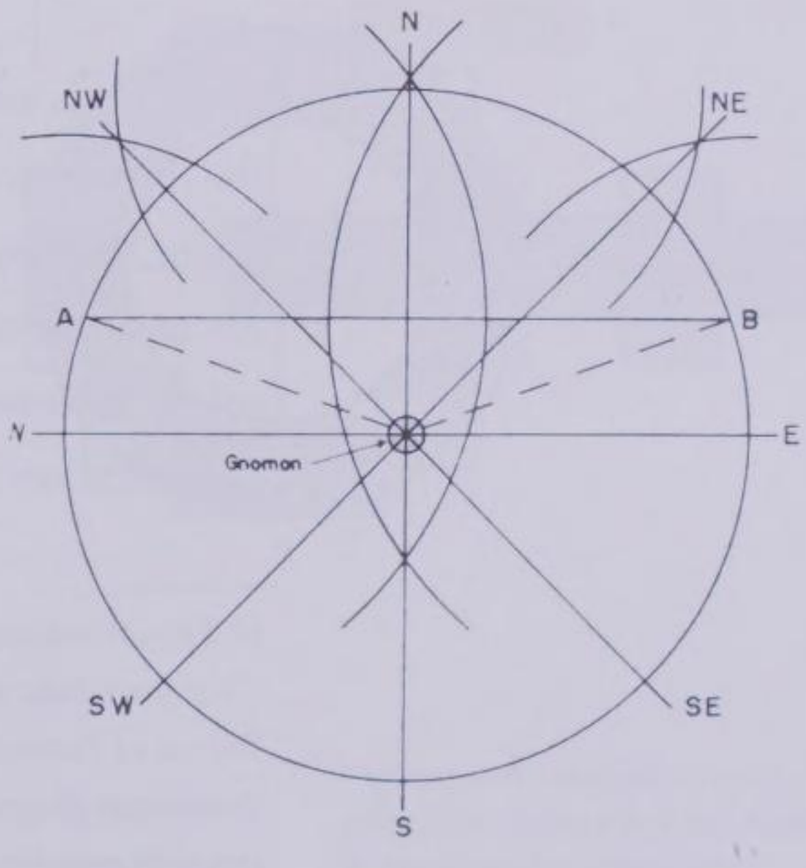
The diagrams given in *Manasara*, the site is divided into subplots starting from single square called '*Sakala* plot' to 100 plots called '*Asana* plot'. It appears to me, the fact that these texts mention 'plots' and not 'parts' implies that it is a sort of a planning feature instead of pure architectural and structural design one.

Beside the criticism of the *vastupurushmandala,* I do accept the symbolic notion of the basic square, as the shape of the inhabited earth, a further detailed analysis of the meaning of the square as well as the circle will be taken up further in this chapter.

I feel instead of considering *vastupurushmandala* as a definitive diagram and also confusing and combining the terms, the scholarship should practically analyse the three terms *vastu* (site), *purush* (man), the different types of *mandala* (diagram) separately. By retaining their symbolic meaning and *vedic* roots, it should be possible for us to address the Indian Temple Architecture in a more reasonable and practical context substantiated by evidence. Because of the orthogonal nature of the *vastupurushmandala*, it would indeed be difficult to construct it on site, besides its inability to conceptually detail intricate temple designs and locate them on site. Besides problems relating to plan, it would be practically impossible to apply it for elevation design and construction. Hence, a method which would use a rod and a string like the method described in ancient texts for site orientation (gnomon method) would be practical (Fig.2.2).

2.2 Symbolism in Sacred Architecture

Throughout the history of mankind symbolism has allowed the expression of multiple meaning – an outer meaning for the masses and a hidden meaning for the initiates.[9]Also we can see that the symbols manifest archetypes according to definite laws, and



Above Shiva temple, Badnavar, Madhya Pradesh

Figure 2.2 Gnomon method

[9] A.T.Mann, *Sacred Architecture*, (Element Books Limited, 1993), p.14

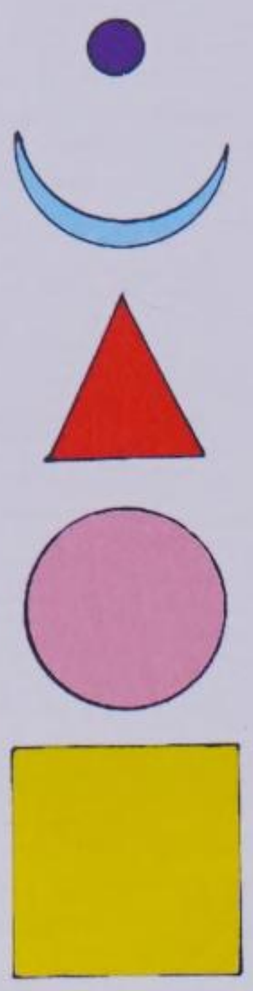


Figure 2.3 The five elements in an ascending order (Earth, Water, Fire, Air and Ether) are the manifested energies of the sphere of earth (one of the eight Vasus) whose active principle is Fire (also one of the eight Vasus)

express their essence through form.[10]There are three ways symbolic or the spiritual is expressed through architecture, the first being sacred architecture reflecting the structure of the cosmos[11], the second way is the application of primary geometrical shapes and proportions using number symbolism or mathematical mysticism. The third expression is through building structure and ornamentation, which uses basic and clear patterns, derived from nature and from the living energies and the geometries derived from them.[12]The probable explanation for the use of similar primary planar shapes (square, circle, triangle etc.) and solid shapes (cube, sphere, pyramid etc.) in all the sacred architecture lies in the discovery, measurement and the canonization of the Solar, Lunar and Planetary cycles by the early civilization. They in due course of time integrated the same numbers, geometrical shapes and proportions into their sacred architecture.[13]

2.3 Squaring of the circle and its symbolic connotations

In order to square a circle, we need to first understand in depth the basic interrelation of the circle to the square. It is derived from the eight *Vasus* as the very meaning of the name suggests that, it encompasses as well as is encompassed by the other elements.

Let us refer to the Spheres, the eight *Vasus* in Danielou Alain's chart of the thirty- three Gods and see how the square and the circle evolve in a temple. There are four sets: Earth-Fire (related to the five elements: Earth, Water, Fire, Air and Ether)[14] Fig. 2.3 shows the 5 elements in an ascending order with the colors associated with them[15], Space-Wind, Sky-Sun (related to *Adityas*) and Constellation-Moon.

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10 Titus Burckhardt, *Sacred Art in the East and the West*, (London, Perennial, 1967)

11 For the Hindu architecture we can relate to the 36 Tattvas (elements), esp the 26 impure Tattvas of Purusa (man), Prakriti (nature), the three Sattva tattvas i.e buddhi (intellect), ahamkara(ego-sense), manas (mind), the ten rajas comprising of five each sense organs(ears,skin,eyes,tongue,nose) and five action agents(mouth, genitals, bowels, hands and feet).Finally the ten Tamas tattvas including the five each subtle elements and five gross elements, i.e. ether, air, fire, water, earth.

12 Mann, p15

13 ibid. pp.17-18

14 Ref. Ajit Mukerjee and Madhu Khanna, *The Tantric Way*, (London, Thames and Hudson, 2003), first published in The United Kingdom in 1977, pp. 108-111 (p.108)

15 Madhu Khanna, 'Archetypal Space and Sacred Sound', in Yantra: The Tantric Symbol of Cosmic Unity, 2nd edn (London, Thames and Hudson, 2003), pp.29-51 (p.40)

At a larger context of the city planning a large variety of ancient cities covering a time frame of 4,500 years, ranging from Harappan city of Dholavira to the capital city of the last great Hindu empire of Vijayanagara have been studied to be relating a varying degree of geometrical order and planning.[16] The purpose of studying cosmic geometry and Cosmogram could be important for the study of the *shikhara* profile as well as the plan.

The twelve sovereign-principles or Adityas[17] have been studied at the urban planning level of Kashi (modern Varanasi) where the 2 aims of the study were established with suitable evidence using the Global positioning System of satellites (GPS) that 'the original temples and shrines of the *Adityas* were placed in a meaningful spatial pattern in Kashi, and the Aditya shrines of modern Varanasi appear to mark the locations of the original temples and shrines as they existed prior to the 12th and 13th centuries. The pattern of the Adityas suggests intentional planning.[18]

Snodgrass describes the squaring of the circle as Spatializing the Time.[19]He explains the process of the earth which is physically spherical or circular in 2 dimensions & how it is formed into a square shape as seen in the temple plan. 'In the ritual of its laying out the square of the temple plan is geometrically derived from the circle. The cycles of the sun are pinned to four directions; the circle of the sun's rotation is squared. In the world of appearances the plane of earth is circular, circumscribed by the circle of the horizon. When structured by the cardinal points, determined by the movements of the sun, it is converted to a square and in this respect it is called "four cornered" (*caturbhrsti*).

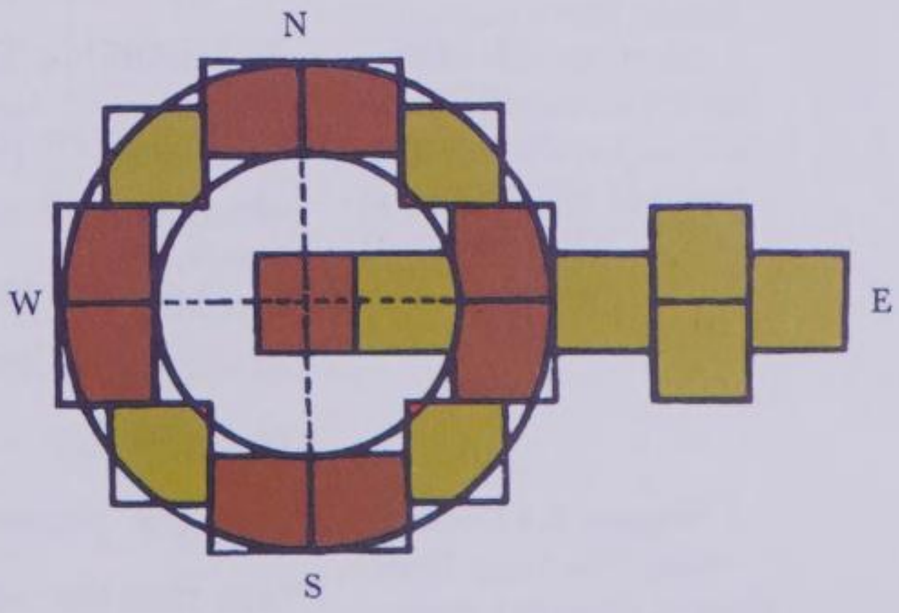

Figure 2.4 Fire Altar, central part of the fifth layer of the Agni of the Soma Sacrifice (courtesy Vatsyayan, 1997, p. 26)

[16] J.M.Malville, Ancient Cities, Sacred Skies, ; Cosmic Geometries and City Planning in Ancient India, (New Delhi, Indira Gandhi National Center for the Arts (Aryan Books International, 2000), pp. 82-99 (p.1).

[17] Adityas means 'Aspects of the Sun'.According to the Hindu Mythology the Adityas are the children of Aditi and Prajapati (RV 1.89.16)

[18] Ref. John McKim Malville and Rana P.B. Singh, Ancient Cities, Sacred Skies; Cosmic Geometries and City Planning in Ancient India, (New Delhi, Indira Gandhi National Center for the Arts (Aryan Books International, 2000), pp. 82-99 (p.82).

[19] Andrian Snodgrass, 'Time in the Hindu Temple', in *Architecture, Time & Eternity: Studies in the Stellar & Temporal Symbolism of Traditional Buildings*, Vol. 1, 2 Vols, (1990) pp.128-41

THE THIRTY-THREE GODS

The Spheres, the Eight Vasus		*Manifest Energies*		*Ruling Deities*	*Caste and Corresponding Qualities*	*Veda and Corresponding Ritual and* Mantra
Sphere	Active Principle					
1. EARTH (*pṛthivī*)	2. FIRE (Agni) Food	Elemental-manifestation (*ādhibhautika*), the natural forces	The five elements	The AŚVINS, the gods of agriculture	*viśaḥ* working-class (youth, skill)	*Ṛk* (meters), morning libation, BHŪR
3. SPACE (*antarikṣa*)	4. WIND (Vāyu) Life breath	Celestial-manifestation (*ādhidaivika*), the subtle beings, deities	9–19. The eleven RUDRAS, the life energies	32. INDRA, Might, the thunderbolt	*kṣatra* warrior-class (maturity, strength, courage)	*Yajus* (contents), midday libation, BHUVAS
5. SKY (*dyaus*)	6. SUN (Sūrya) Intellect	Individual-manifestation (*ādhyātmika*), the moral forces	20–31. The twelve ĀDITYAS, the sovereign principles	MITRA-VARUṆA, the cosmic law, relation of man with man and man with gods	*brāhman* priestly-class (old age, wisdom)	*Sāman* (extension), evening libation, SVAR
7. CONSTELLATIONS (*nakṣatra*)	8. MOON (Soma) Seed, offering, ambrosia, immortality	The Unmanifest, the Fourth stage	The Unmanifest, the Ancestors	SVAYAMBHŪ, the Self-born PARAMEṢṬHIN, the Supreme Will	*sannyāsa* asceticism, eternity, timelessness	AUM

Figure 2.5 Danielou Alain, 'The Thirty-Three Gods' in *Hindu Polytheism*, (London, Routledge & Kegan Paul, 1964), p. 83

The process is rich in symbolic connotations. The *Satapatha Brahmana* says that the square hearth made up in the *agnicayana* sacrifice is the Heaven World and the round hearth is the World of Earth. Accordingly, in one of its many meanings, the squaring of the circle is a marriage of the complementary principles, Heaven and Earth, *purusha* and *prakrati*, by whose conjunction the world comes into existence. The circle, the most dynamic of geometric figures, is the image of the ceaseless flux and mutability of the Earth World; and the square, the most static and stable of geometric figures, is the image of the permanence and immutability of the world of Heaven. The union of complementary principles, represented by the circle and the square, is reflected at a number of levels: at one level it is the

marriage of space and time.[20]This symbolic expression is similar to that of Vatsyayan's expression of the Fire altar form, where brick is as a unit of space and time was arranged in a pattern to express the same union between the two. Similarities can be drawn from the intersecting circles which represent the Astronomical equations based on time units with the two intersecting circles of the SCS when applied to *prasada* and *mandapa* of a temple.

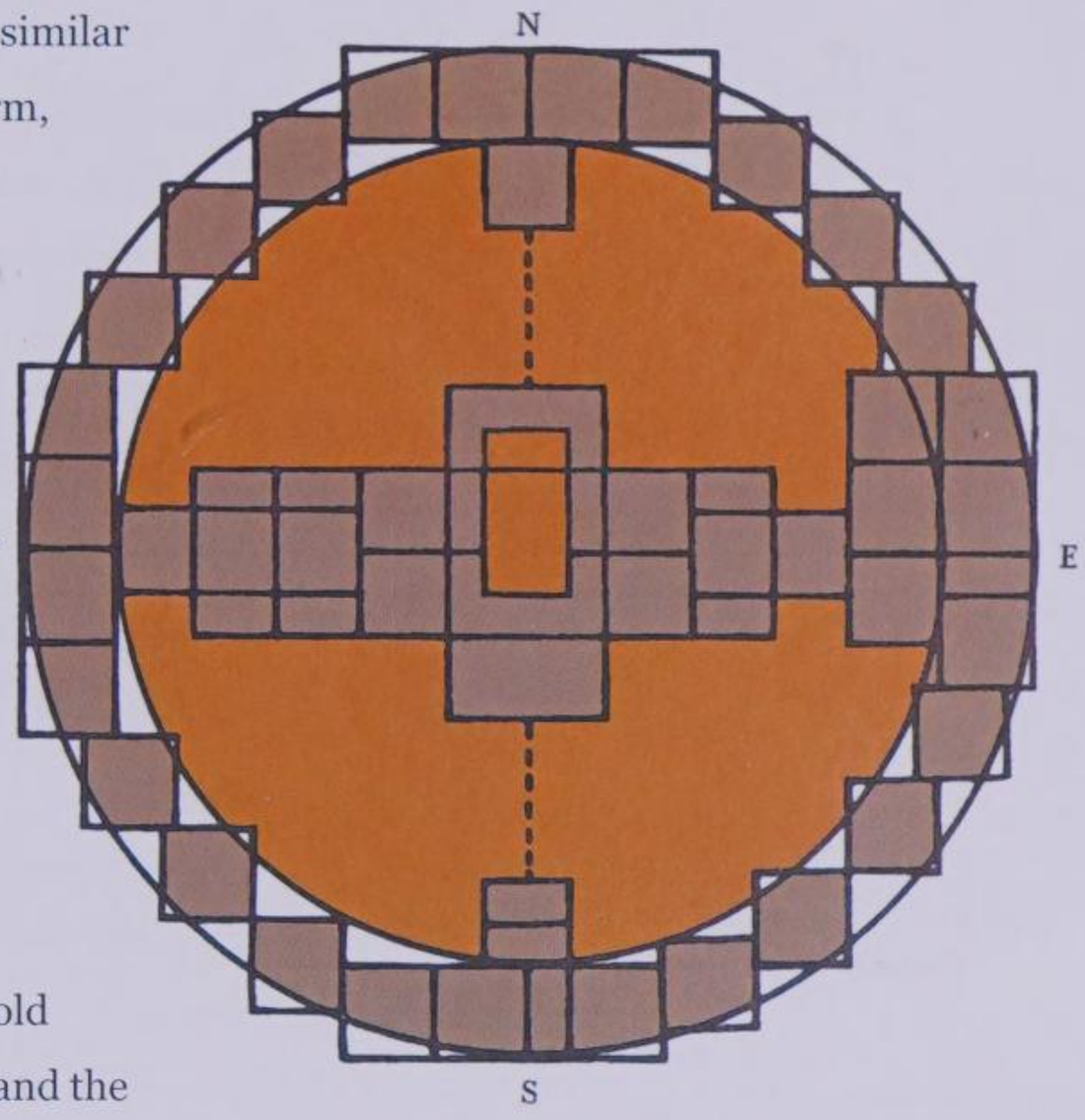

Figure 2.6 Fire Altar having interlocking 360 circular patterns represents the space where each brick from a total number of 360 represent a day (time). Central part of the fifth layer of the Agni of the Soma Sacrifice (courtesy Vatsyayan, 1997, p. 26)

2.4 Hindu Polytheism Forming a Basis of Temple Design and Planning Principles

In the *Brhad-aranyaka Upnashid* (3.9.1) it has been told that in response to *Sakalya's* inquiries about the number and the nature of Gods the sage *Yajnavalkya* replied that there are 3306 Gods and then he says they are 6,3,2,1.5 and 1 Gods.[21] He then further states that the Gods are 33 in number. Clarifying the confused *Sakalya* doubts he further states that there are 33 gods and the others are their spheres of expansion. It is these spheres of expansion, which are probably denoted as concentric circles in 2 dimensions. The classification of these 33 Gods is the eight- 'spheres'- of existence (*Vasus*), the eleven divinities-of-life (*Rudras*), the twelve sovereign-principles (Adityas), the rule-of -heaven (Indra) and the lord-of-progeny (*Prajapati*). Amongst these 33 Gods the eight *Vasus*[22] or spheres-of- existence (Fire, Earth, Wind, Atmosphere, Sun, Sky, Moon and Stars) are the ones represented by the planar shapes (Fig.2.5).

2.5 Possible derivations from the fire Altar

The fire (*Agni*) is also an important element for symbolic representation and also occupied a prominent place in the Vedic period.There is a school of thought, that *Agni* as an anthropomorphic God, having mention in the *Mahabharata* and the *Vishnudharmottara Purana* (Bk.III, ch. 56, Vs. 1-10), however looses mention in

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[20] Ibid, Snodgrass, p.137

[21] Danielou Alain, 'The Thirty-Three Gods' in *Hindu Polytheism*, (London, Routledge & Kegan Paul, 1964), pp.79-84 (p.79)

[22] Vasu means Dwelling or Dweller; In Vasu the world dwells and in the world the Vasus dwell. According to the Unadi Sutra (1.11 [118]), Vasu means, " that which surrounds."

the latter text like the *Brahatsamhita* and the *Rgveda,* and gains importance as a metaphorical imagery.[23] But whether we read any thing into the seven rays as part of the anthropomorphic representation of the Fire God into the analysis or representation of the temple is yet to be analysed.

A link between the ritual practice of the fire altar and the *yantra* is usually established, because of the use of standard sized and specified shapes (rectangular or *adhyaardha*, triangular or *adhyardhardha* and the square or *pancami*) of the brick in an interlocking pattern.[24] Incidentally, these fire altars are not just made from careful calculations of measurements of the both the ground plan but its elevation too.

The unit of measurement is a single brick, which represents 1 day and hence the cyclic pattern is achieved by the use of 360 bricks = 360 days.[25]The fire altar not just represents the universe on this earth (space), but also the cyclic year and the eternal (time) in its form and formation techniques. (Figs. 2.4 & 2.6) The 5-tier form represents the five seasons and the measurement corresponds to the annual and the cosmic time. Using this direct significance and application of the space and time to the form of the fire altar, we can see whether there is any similarity in approach for the Hindu temple form which is a larger and more structural aspect to the same cosmic doctrine of *Bhuh ghuvah svah* (earth, sky and heaven).

Hence, we see that geometries utilizing lines, squares, triangles, rectangles and circles were used intensively as a means to recreate the link between the interior spaces (microcosm) and the larger cosmos (macrocosm or mesocosm) and this geometric connection is easiest explained by cardinal orthogonality which later becomes more physically pronounced by the development of the stellate temples. Here the macrocosm consists of north celestial pole, stars, planets, moon and sun, the mesocosm of the atmosphere, mountains, lakes, oceans and rivers, the microcosm of the city, temple, home and the body.[26]

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[23] Madhulika Sharma, 'Fire Worship in Ancient Indian Art and Archaeology', in Fire Worship in Ancient India, (Jaipur, Publication Scheme, 2001)

[24] Kapila Vatsyayan, The Ritual of the Yajna, in *The Square and the Circle of the Indian Arts*, 2nd edn (New Delhi, Abhinav Publication, 1997), pp.32-36 (p.)

[25] ibid, 1997, p.27

[26] Malville, 2000, p.2

Shivalinga, Udeshvara temple,
Udayagiri, Madhya Pradesh

3-Development of the 'Square-Circle-Sequence' Diagram & Its Governing Principles

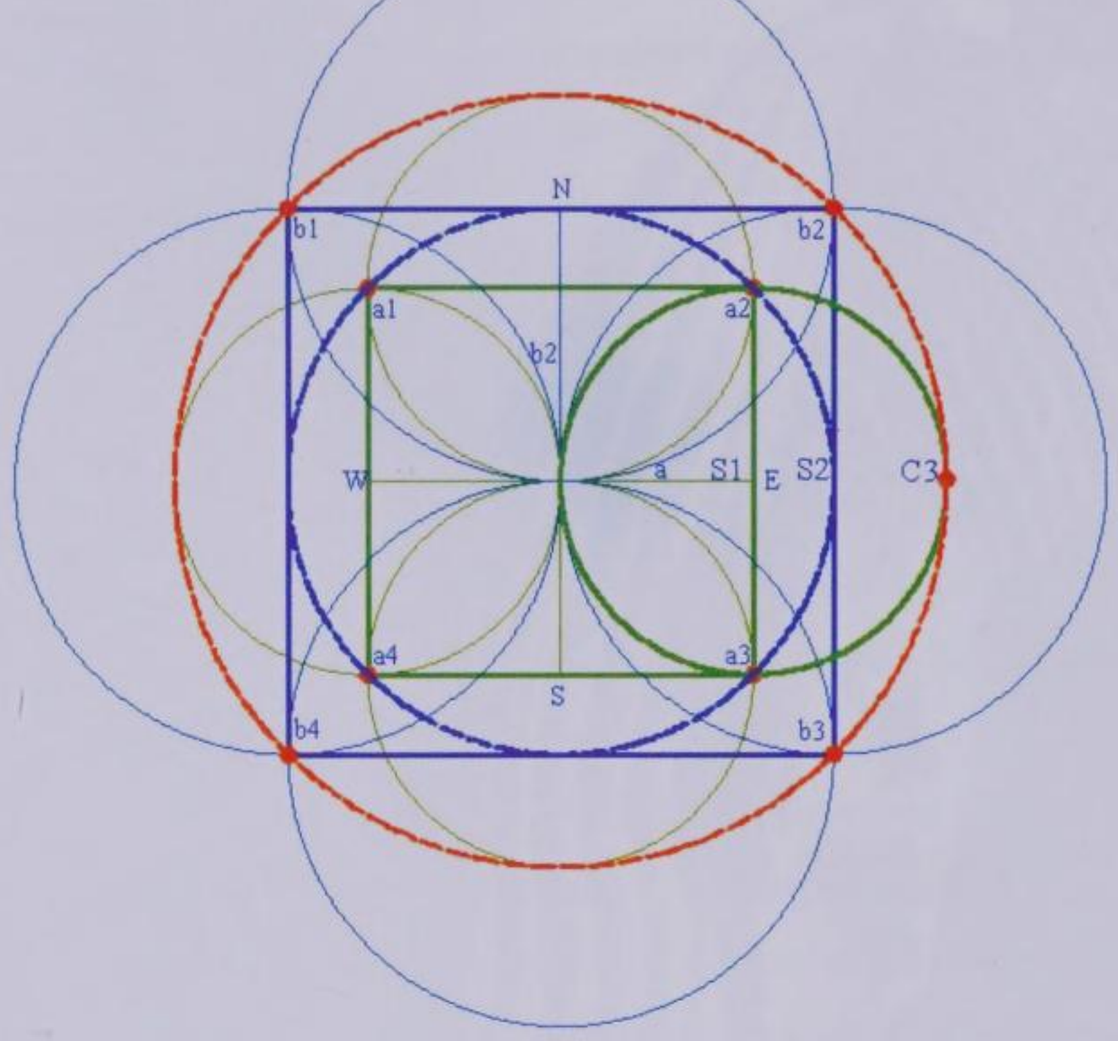

Figure 3.1 Construction method of SCS

3.1 Development of the Square-Circle Sequence for Temple Design and Planning

The creation of the Square-Circle-Sequence is a method of interconnecting the symbolic realms of the cosmos. Kramrisch sets the roots of the basic shapes of the square and the circle in the *vedic* times. As has been shown in the previous chapter the square and the circle are co-ordinated in the architecture of India from the *Vedic* Fire altar, *Agni*.[1] Although the square is considered as the perfect and essential form of Indian Architecture, it presupposes the circle and results from it. Much has been written about the symbolism of square (*caturasrikarana*), whose literal presence in the architectural schemes is very obvious. Whereas, the symbolism and possible application of the circle, which is hidden from the eye has been left

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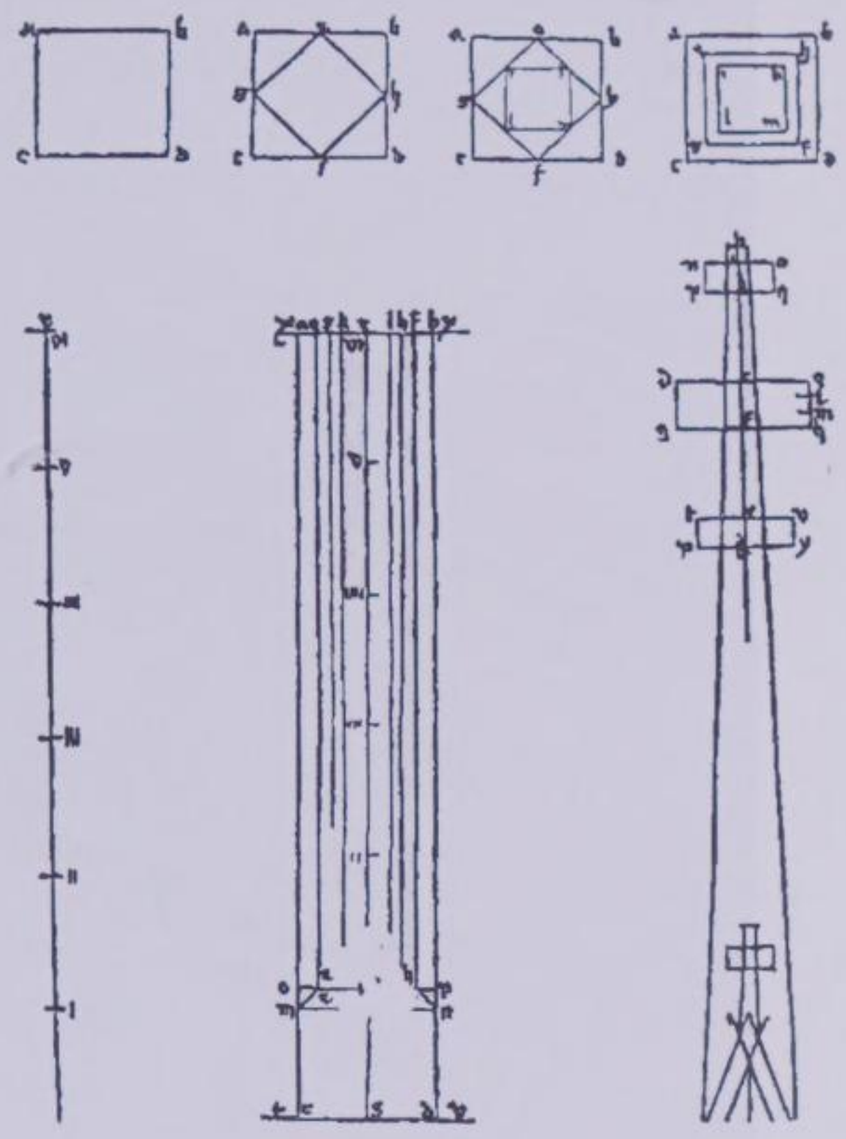
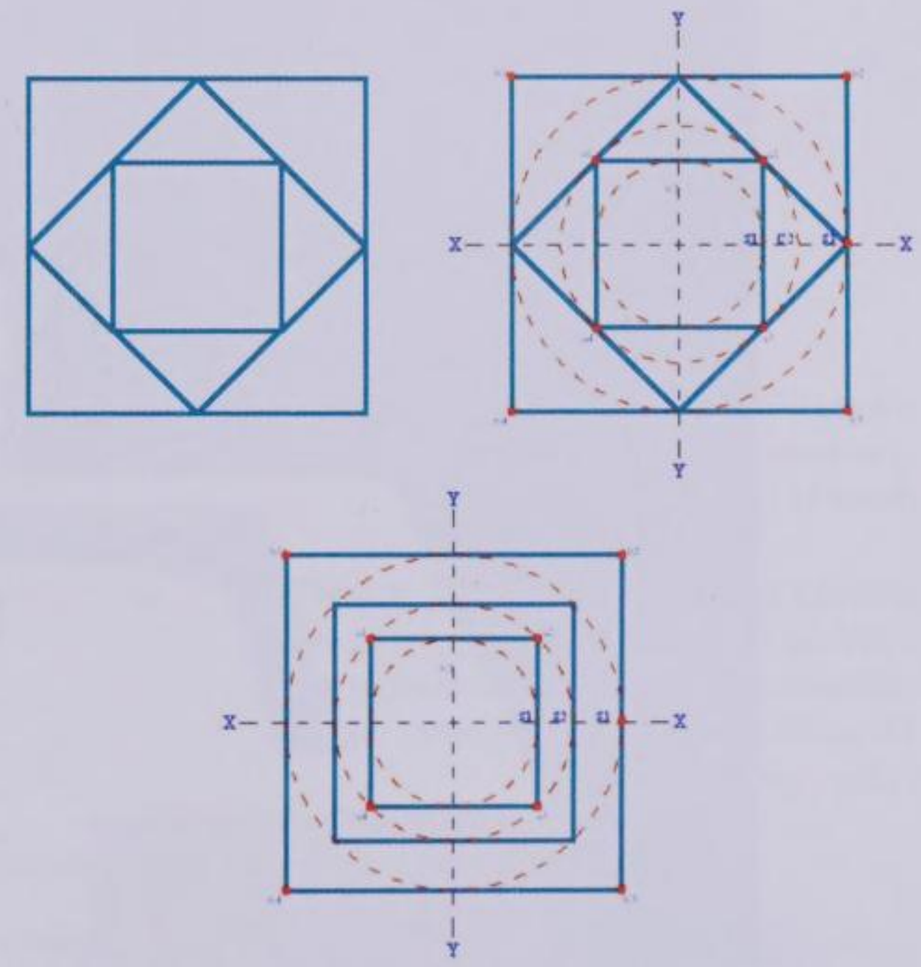
[1] Stella Kramrisch, 'The Plan' in *The Hindu Temple* 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996) pp. 21-8, p.22

out by scholars. Describing the relevance of square she quotes from the Mayamata, III.1, "The shape of the *Vastu* for gods and *Brahmanas* is prescribed as square." Relating to the importance of the square she calls it literally the fundamental form of Indian architecture. She describes the prescription given by Bhadhayana for constructing a square from a circle in the Baudhayana Sulva Sutra I.22-28,[2] "it requires a cord (*sutra*) of the desired length of the square, its division in half, fixing of the poles in the middle of the east-west line and at the cardinal points, and the drawing of the circles from these points with the length, and half the length of the cord respectively for radius. The exterior points of intersection of a diameter equal to the length of the cord are the four corners of the required square field." Hence, we can find that besides being literally co-ordinated with a square, a circle is essential for the construction of the square.





From top to bottom

Figure 3.2 Roriczer's diagram, courtesy Sonit Bafna, 'On the Idea of the Mandala as a Governing Device in Indian Architectural Tradition', in JSAH / 59:1, (March, 2000)

Figure 3.3 Analysis of Roriczer's diagram

In Fig. 3.1 the method of construction of the square (S1) as explained above is shown. To start the cardinal axis N-S and E-W are drawn. In order to draw the first square 'S1' whose side is equal to '2a', four circles shown in green are drawn keeping their centers as the ends of the cardinal axis. The intersection points 'a1', 'a2', 'a3'and 'a4' of these four constructing circles are joint to give the first square. Next in the sequence is the circle, which touches these four corner points of the first square. In order to create a square on the second circle, we follow the same procedure as the first, this time the radius of the four constructing circles is half of the required square width 'b2', which is same as the radius of the circle circumscribing the first square. Again, the intersection points created by the four construction circle are joined to give us the second square 'b1-b2-b3-b4'. Now, the circle which is created by joining the points of the second square touches the outer quadrants of the construction circles of the first square (indicated by nodes).

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[2] ibid, p.22. see footnote for the names of the other Sulva Sutras which mention similar methods for construction of the square.

The belief that the *Vastupurushamandala* is a governing diagram for Indian Architecture has received some valid criticism for its lack of context in any traditional literary texts and manuals. In order to validate my proposed Square and Circle geometry for the Indian temple, it becomes meaningful to find some evidence. Roriczer's diagram[3] can be interrelated to support my theory (Fig. 3.2). The basic plan figures shown in Roriczer's diagram have circles hidden in them (Fig. 3.3).

Let us consider the central point of the square (*Chaturasra*) and its circumscribed circle. The realization that it is this square and the circle that govern the geometry of the plan at a large extent was triggered by Andreas Volwahesen study of the Brihadesvara temple at Tanjavur, where he uses the concept of expanding squares and circles to show the spatial planning of this south Indian temple complex.[4] I had developed the idea of more than one approach to the temple planning in the initial stage of my research. My approach propagates the use of an integrated multiple governing device concept which could encompass concepts like the *mandala,* the diagonal grid, the *yantras*, the proportion system based on key dimensions of the *garbhagriha,* the deity or its pedestal, the use of 6 *'Avadisadvarga'* formulas for identification of key overall measurements, orientation of site and structure, and finally the design of the temple and its constructional geometry. Figurative similarities can be drawn between the SCS and the ritualistic representations of the zodiacal divisions

3.2 General properties of the SCS

Before we take a search for the missing links in the temple plan and elevations with the help of Square-Circle-Sequence (SCS) it is important to look at its general properties.

The relationships between the sequential squares and circles can be well established. Besides having a relation with each other in measured dimension, the squares as well as the circles are related in their areas.

Previous Page Sivalinga, Batesvara Mahadeva Complex, Batesvara, Madhya Pradesh

Figure 3.6 Chart of the twelve zodiacal divisions in relation to ritual. Rajasthan, ca. eighteenth century, Ink and colour on paper. (courtesy Ajit Mookerjee Ritual Art of India, 1998, p.32)

[3] Sonit Bafna, 'On the Idea of the Mandala as a Governing Device in Indian Architectural Tradition', in JSAH / 59:1, (March,2000), pp. 26-49, (p.36)

[4] Andreas Volwahesen, 'Early Nagara Style', in *Living Architecture: Indian*, (New York, Grosset & Dunlap, 1969), p.144.

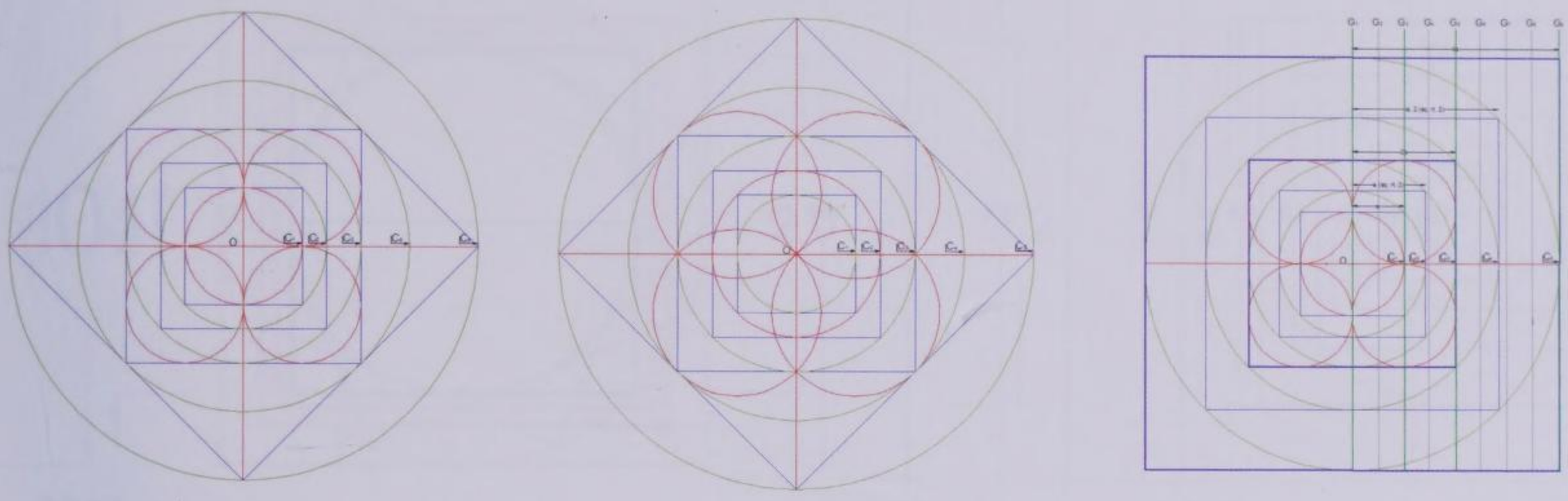
Inside the Sanctum, Mahadeva, Batesara temple, Batesara, Madhya Pradesh

Relationship of the circles, with respect to their radius, areas, circumference has been shown in Fig. 3.7.

In the Fig. 3.4 and Fig. 3.5, the first circle is 'C1' and next concentric circle is 'C2' .....Cn, where the center of the concentric circle is 'O'. Fig. 3.6-3.7, show that the doubling of the measurement for the radius and circumference happens alternatively, i.e. radius/circumference of 'C3' is double of 'C1' and the radius of 'C4' is double that of 'C2' and the radius of 'C5' is double that of 'C3'. Also the comparison between the areas of alternate circles becomes 4 times, i.e. the area of 'C3' is 4 times that of 'C1' and the area of 'C4' is 4 times that of 'C2' and also the area of 'C5' is 4 times that of 'C3'(Fig. 3.7).

3.3 Ratios between expanding squares of SCS

The SCS is a generic figure which will have a sequence for its side of the square in the following order. The side of the first square is 1x, where 'x' is the actual



Left to right
Figure 3.4 Step1 of the Square and the Circle Sequence (SCS). **Figure 3.5** Step 2 of the Square and the Circle Sequence **Figure 3.6** Relation ship of the Square-Circle-Sequence to the grid: Alternate squares of the SCS viz., the first, third and fifth square matches with the orthogonal grid

MEASUREMENT	CIRCLE 'C1'	CIRCLE 'C2'	CIRCLE 'C3'	CIRCLE 'C4'	CIRCLE 'C5'	
RADIUS	$R_1 = r_1$	$R_2 = \sqrt{2}.r_1$	$R_3 = 2.r_1$	$R_4 = 2\sqrt{2}.r_1$	$R_5 = 4.r_1 = 2.r_3$	
CIRCUMFERENCE	$C_{i1} = 1.c_1$	$C_{i2} = c_2 = \sqrt{2}.c_1$	$C_3 = c_3 = 2.c_1$	$C_4 = 2\sqrt{2}.c_1 = 2.c_2$	$C_5 = 4.c_1 = 2.c_2$	Where, circumference 'C' = $2\pi r$
AREA	$A_1 = 1.a_1$	$A_2 = 2.a_1$	$A_3 = 4.a_1$	$A_4 = 8.a_1$	$A_4 = 16.a_1$	Where, area 'A' = πr^2

Figure 3.7 Measurements of circles in the Square and the Circle Sequence (SCS).

dimension of the side of the square. Fig. 3.8 shows the sequence as 1x, 1.4x, 2x, 2.8x, 4x, 5.6x, 8x, 11.3x, 16x...We can note alternatively the dimension doubles. I am considering a decimal system of proportioning which can be easily converted to a 'by-parts' system similar to 'feet and inches'.

Now let us consider the first square having its side equal to '1x' and the second square as shown in Fig.2.11 will be '1.4x'. If the first square is rotated at 22.5^0 to construct a 16 point star shape, the subsequent squares that can be drawn through their intersection points will have their sides equal to '1.1x' and '1.2x'.It will be shown in the various examples taken up in the study, that the *garbhagriha* in most of the cases actually lies on squares drawn by this method. The *garbhagriha* will coincide either with the '1.1x' side square or the '1.2x' side one (Fig. 3.9).

If the dimension of '1x' is say 2, where the value 'x' is 2 then, as depicted in Fig.3.10 the values of the sides of the SCS squares doubles.

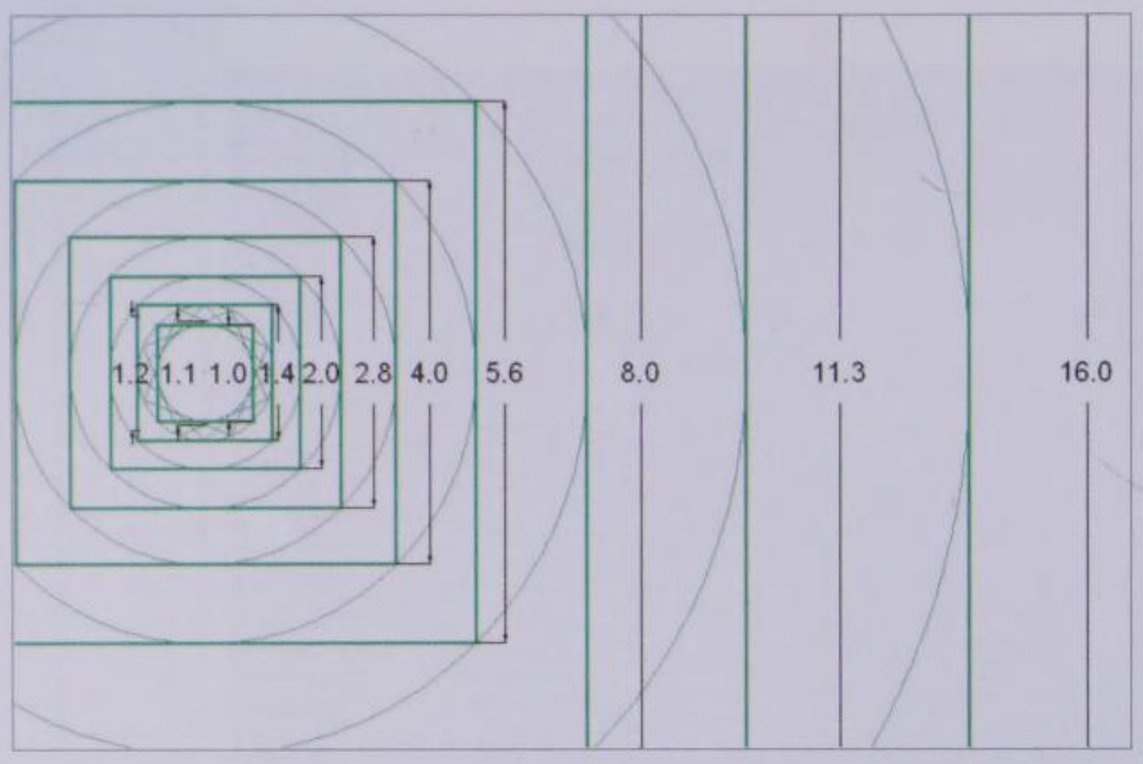


Fig 3.8

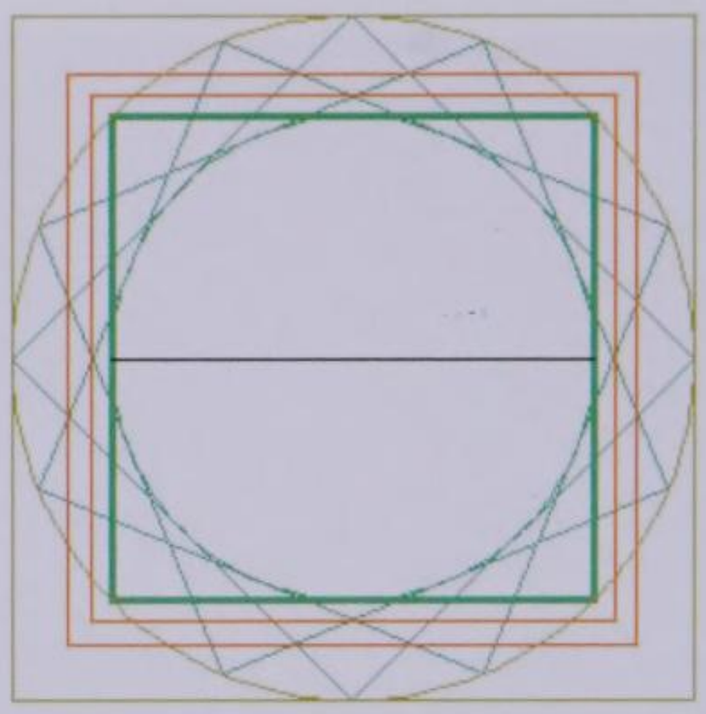


Fig 3.9

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Clockwise from left
Figure 3.8 Ratios between expanding squares of SCS

Figure 3.9 Ratios (1: 1.1 : 1.2 : 1.4) between the first (1), second square (1.4) and the two intermediate squares generated with the help of the 16 pointed star shape of the first square of the SCS (1.1 and 1.2).

Figure 3.10 Proportionate change in Ratios (2: 2.2: 2.4: 2.8 from 1: 1.1:1.2: 1.4) of the first, second and the two intermediate squares of the SCS when the dimension of the first square doubles from 1 to 2.

Figure 3.11 Change in proportions of the SCS when the *garbhagriha* wall coincides with, the first intermediate square, generated from the *marmas* of the 16 pointed star shape of the first square.

Figure 3.12 Change in proportions of the SCS when the *garbhagriha* wall coincides with, the second intermediate square, generated from the *marmas* of the 16 pointed star shape of the first square.

3.4 Location of Garbhagriha with respect to SCS

Case 1 (Fig. 3.11)

In terms of proportioning, if we go by the proportioning chart (Appendix 1), the side of the sanctum (*garbhagriha*) is usually given. In some of the temples like the Bahu temple, Nagada, Rajasthan, *ca.* A.D. 975-980 and Lakshmikanth temple, Jaisalmer, *ca.* mid tenth century, the *garbhagriha* some times coincides with the SCS. Most of the times the *garbhagriha* square does not match with the SCS square, but instead it is generated from the rotated squares of the SCS squares.

In the first case, where the *garbhagriha* is generated from the first single intersection point (as in Maniyamama temple, Dedara,Gujarat, *ca.* A.D. 925), we consider this square to be '1x', then again we will be able to relate the dimension of the *garbhagriha* '1x' to the SCS sequence. In this case the first square (lying inside the *garbhagriha* square) as shown in the Fig. 3.11 will be '0.9 x', the square which will be passing through the second set of intersection points will be '1.1x'. The diameter of the inscribed circle will be equal to the side of the square. The second square of the SCS will be '1.3x' and the further the sequence thus formed will be, '1.8x', '2.8x', '3.7x', 5.2x', '7.4x', '10.4x', '14.7x', '20.8x', '29.5x', '41.7x'.....

Case 2 (Fig.3.12)

The second case is, when the *garbhagriha* will be lying on the second pair of the intersection points of the rotated 16 point star shape of any square of the SCS (Vishnu temple, Batasha, Madhya Pradesh *ca.* tenth century, Siva temple, Nohata, Madhya Pradesh, ca. A.D. 950). Again we can consider the

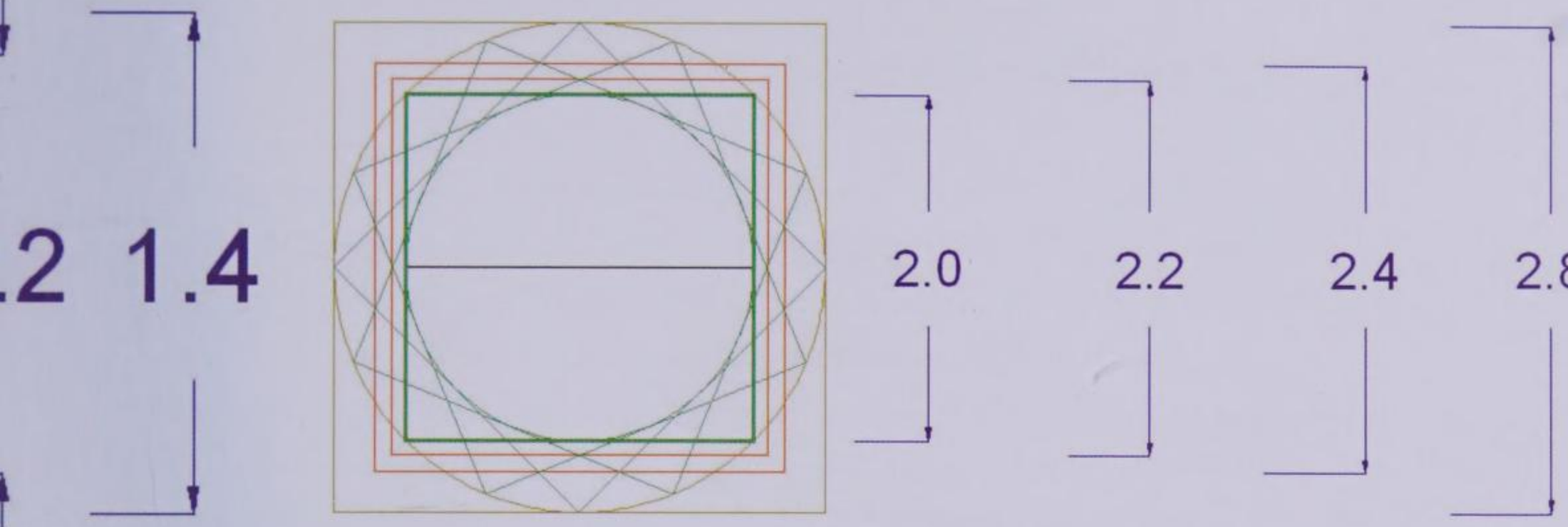

Fig 3.10

garbhagriha square as '1x' and relate it to the other squares of the SCS as in the previous case. Now the first square of the sequence will be '0.8x' and the square passing through the single intersection point will be equal to '0.9x'. The rest of the sequence will be '1.2x', '1.7x', '2.3x', '3.3x', '4.7x', '6.6x', '9.4x', '13.3x', '18.8x', 26.5x', '37.5x'.

Case 3

The third case comprises of those temples which have rectangular *garbhagriha*. In these cases where the *garbhagriha* is rectangular in shape, both the inner single and outer double intersection '*marma*' points are used (Nilkantha Mahadeva, Sunak, Gujarat, South-west shrine, Kunda-vapi, Dedadara, Gujarat, *ca.* A.D. 925). Further an important observation can be made that the first square or the circle of the SCS sequence will be the diameter of the Shiva-*linga* in case of Saivite temples. The circle of the receptacle of the Shiva-*linga* (*yoni-pitha*) will all be part of this SCS. Hence the *garbhagriha* will then be related to the rotated square of the 5th - 7th such square of the SCS sequence. Even in this case all the relationships between the Shiva-*linga*, yoni-*pitha*, *garbhagriha* inner wall (*antarabhitti*) can be numerically established.

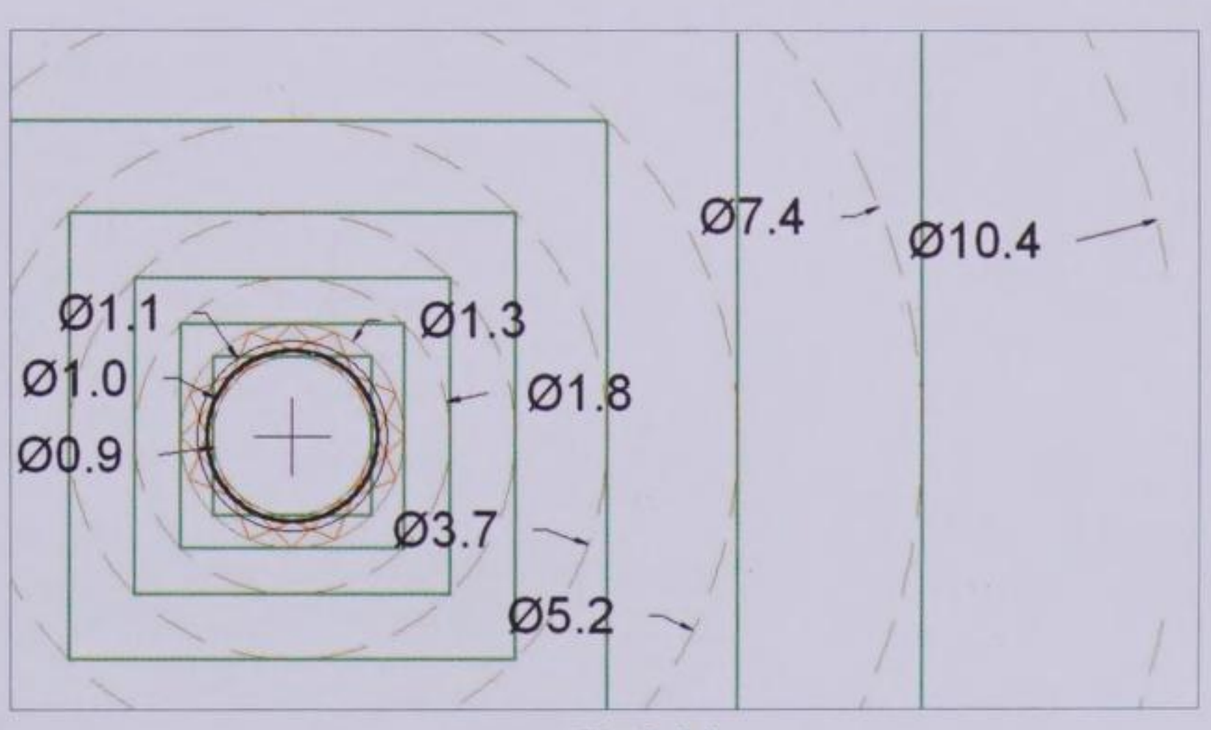

Fig 3.11

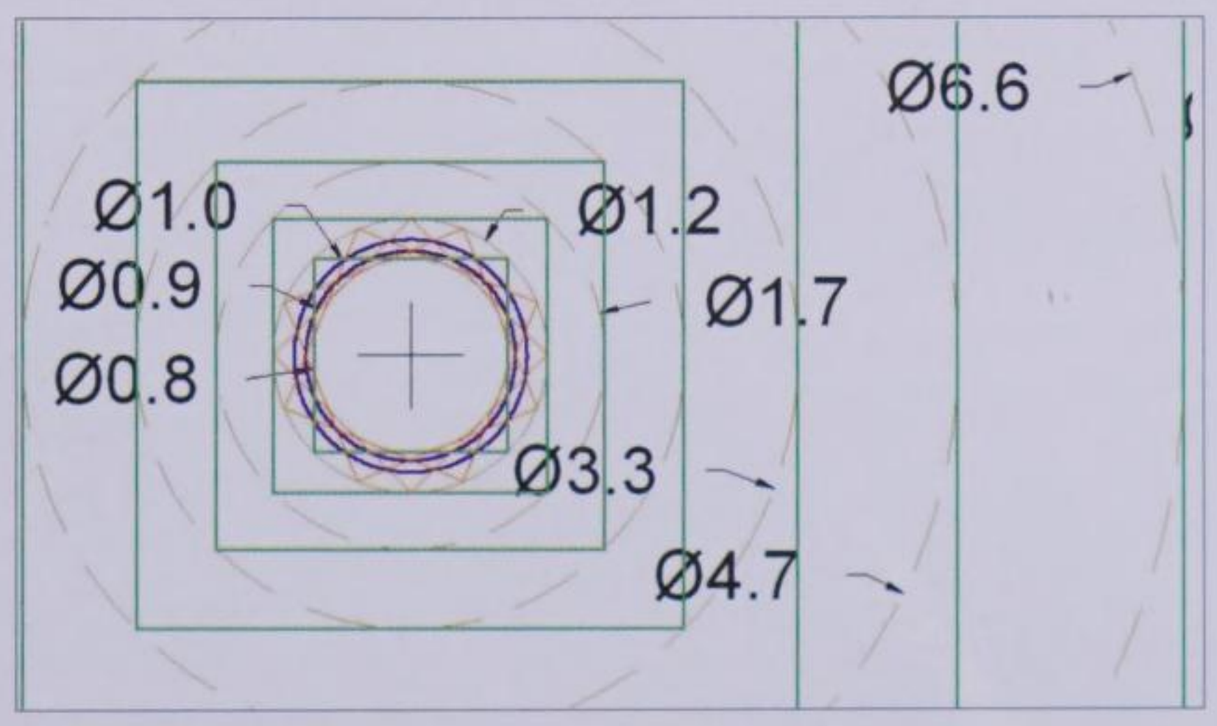

Fig 3.12

3.5 First Square of the sequence

At the time of initiating the SCS concept, I had not resolved the issue of the first square /circle of the SCS. Initially while studying Lakshmana temple, Khajuraho I had considered the *garbhagriha* as the first square of expansion or the starting point of the Square-Circle-Sequence (SCS from now onwards). Only afterwards upon reading and converting Kramrish's chart on proportions of temples, I realized the importance of the image or the image's pedestal as a starting square of the SCS.[5] Now having established the geometric interpretation and the construction technique of the square and circle sequence (SCS), we can study the use of square and the circle principle in a temple plan and the complete temple structure a bit further. It is important to understand why this sequence of square and circle be used in the first place.

3.6 Deriving rekha through SCS and its analysis

With the application of the demonstrated methods, the relationship between the plan geometry and that of the *rekha* geometry can be established. As it will be shown further in the study that the *rekha* profile is a segment of the SCS circle. Thus, the *Shikhara rekha* will not just be numerically related to the other SCS squares but also to the *garbhagriha* dimensions as well. For the sake of analysis, it is possible to establish a relationship between the radius of the *rekha*, height of the *shikhara* and the difference between the *skandha* and the base of the *shikhara* with the help of algebraic equation.[6]

Say, the radius of the circle which defines the curve of the *shikhara* is 'r' and the height of the *shikhara* from the base to the *skandha* is 'h'. Two lines are formed joining the center of the circle 'O' with the base of the *shikhara* 'O´' and the other joins the top of the *shikhara* curvature to the center of the circle 'O-O´´' (Figs.3.13 - 3.14). The angle thus formed between the two lines is the angle 'a' of the *shikhara*

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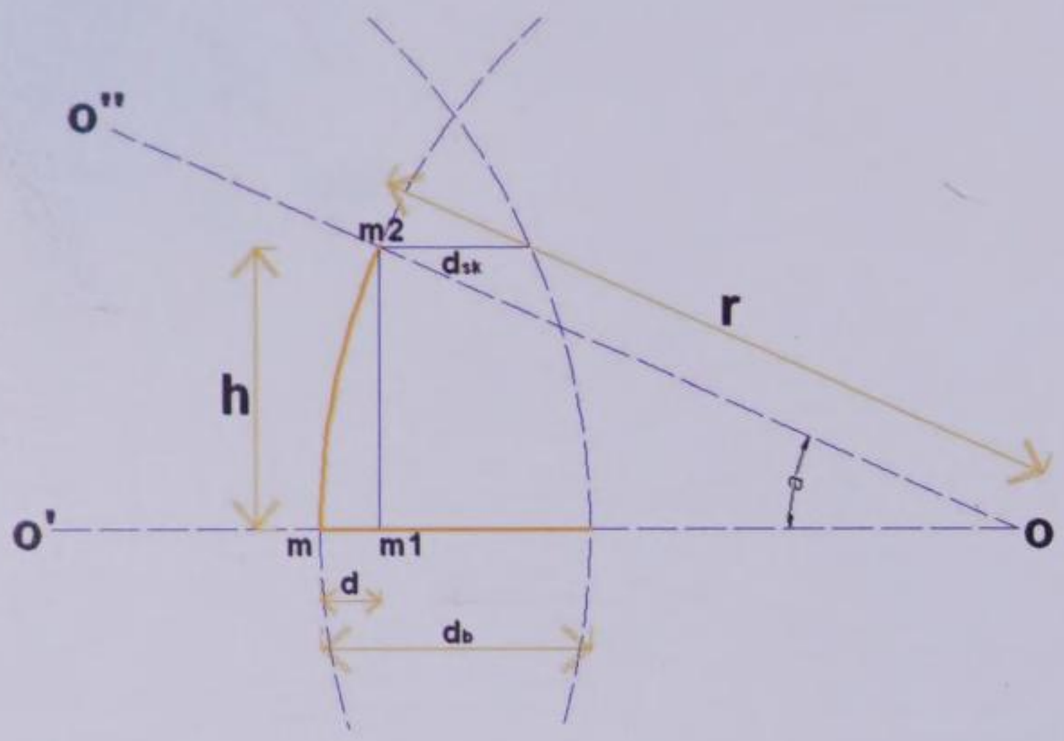
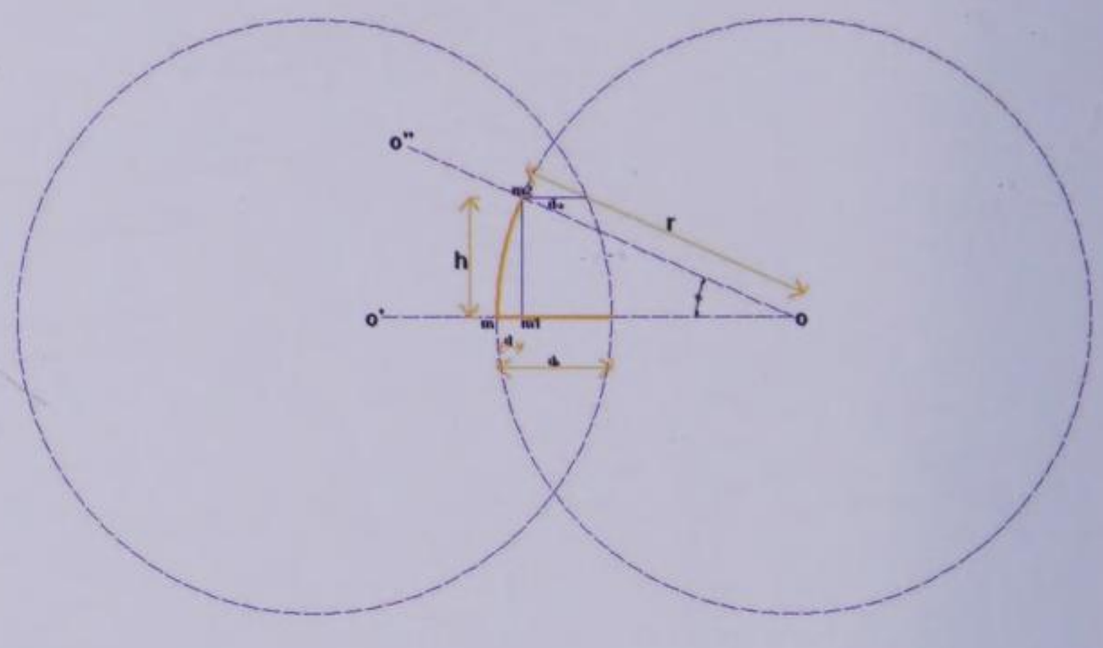
[5] Stella Kramrisch, 'Proportionate Measurement and Varieties of the Temple' in The Hindu Temple 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996) pp. 227-270

[6] I would like to thank James Christian Thomas, Ph.D scholar at School of Mathematics, Cardiff University, U.K. for helping me with these formulas. I propose to undertake further research, jointly with a mathematics dept. to analyse the possible numerical and mathematical options of the *rekha* curvature. An analysis of the role of the *bhumis* in design and construction of the *shikhara* would definitely yield interesting results.

Shivalinga worship Umarga,
courtesy Gerard Foekema





From left to right
Figure 3.13 Geometrical relationship between the radius of the *rekha*, height of the *shikhara* and the *skandha* and the base of the *shikhara*.

Figure 3.14 The *rekha* segments shown as part of a complete circle, along with the height of the *shikhara*, the *skandha* and the base of the *shikhara*.

segment is equal to 'θ°' [θ radian = (π/180) °].

The equations thus formed are h = r tanθ°, d = r (1-Cosθ°) and the segment of the circle 'm1-m2' = r. π/180.θ°. I propose to address the possibility of converting the geometric data to numeric one which could further help us understand the divisions of *bhumis* in a *shikhara* and its possible construction method at a latter date.

Bhumija Temple, Nemawar, Madhya Pradesh

4-Extracting Possible Solutions from texts on Sculpture and the Natyasastra

The term *Vastu*, can some times be used in a more general form for the structural principles and also the expression of the basic form- language, which would encompass both architecture and sculpture.[7] Vastusutra-Upanishad forms a good basis of comparison between architecture and the other arts. The Vastusutra-Upanishad is attributed to the Paippalada Kalpa of the Atharvaveda presents a challenge to various disciplines: to the indologists, because it is the first text on *Silpa* or *Vastu* called an Upanishad. There are five different copies, four in Oriya characters and one in Devanagari.[8]

According to Baumer, the use of the architectural term *Vastu* in the title of *Vastusutra-Upanishad*, a text that is meant for sculpture, speaks more of '*rupa*' and '*silpa*' of the sculpture. Here, the meaning of the term '*vastu*' is associated more with the ground plan, the dwelling place and abode of Gods in an image-panel, not with a temple.[9]

The parallelism between the science of *Sulva* and *Silpa* is constantly demonstrated in the *Vastusutra-Upansishad* as can be seen in the case of the *Yupa*, or sacrificial post, and its anthropometric transformation in the image of the *Purusa*. Again the common element, which justifies the title Vastusutra-Upanishad, is sacred geometry underlying sacrificial altars and so on (*Sulva*), anthropomorphic images and image-panels (*Silpa*) and sacred or secular architecture (*Vastu*).[10] According to Baumer the comparison between the use of geometry is, in the case of architecture of the temple primarily only technical without any inner meaning, whereas, the geometry used in the *Silpa* is more infused with inner meaning (*bhava*), I feel that is not entirely true. Never the less, some important derivations can be made from these comparisons, even though they are only technical. Here I

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[7] Alice Boner, Sadasiva Rath Sarma and Bettina Baumer, Vastusutra Upanisad: The essence of Form in Sacred Art, 3rd rev. edn (Delhi, Motilal Banarsidas, 1996), p.

[8] ibid. p.1

[9] ibid, p. x

[10] ibid, p. xi

Detail, Osian, Jodhpur, Rajasthan

Ceiling detail,
Paravali ki Ghari,
Madhya Pradesh

am relating some parts of the *sutras* directly from the second Chapter of this text, which relates to the Compositional Diagram.[11]

4.1 Derivations from the Four Actions of a Sculptural Diagram

4.1.1 The Setting and Polishing Action

After starting with, 'Now follows the knowledge of the *Kilapanjara*[12] (compositional diagram) of which I explain the procedure,' and the *Sutras* 1-3 are about the initiating the sculpture where we see emphasis being laid to the meaning of the form, in the first Sutra, 'An image should be envisaged to express a specified meaning'. The second and the third sutras deal with 'actions' of setting and polishing the stone.[13] The setting of the circle also can solve the question of the square of the *garbha-griha* as the first square on which the circle is inscribed. I have proved earlier that the circle of the Shiva lingam or the image itself is the initial point of starting of the temple plan and not the square.

4.1.2 Tracing Action

A lot of similarities can be drawn from the sutras relating to the tracing actions,

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[11] ibid, pp.53-65

[12] The secret method by which images obtain their measure and proportion (pramanyam) is the khilapanjaravidya. It means that it is uncommon, a secret knowledge of lines.

[13] 'Setting, polishing, tracing the lines, these are the three processes. Carving is the last work, the sthapaka should always remember.' Kasyapa samhita 1.14

Chamunda Parvali ki
Ghari, Madhya Pardrsh

which are described in detail. Sutra 3 deals with the start of the tracing action of the circle and the center point. 'Then the circle is traced: drawing a circle with a stick of *yujuva* wood[14] (*ber* tree) attached to a ring and a peg by means of a rope (while uttering the mantra).With this mantra the central hole should be established.'

As apposed to the generalization of the meaning of the term '*marman*' in the architectural context as an intersection point here it means the central point.

The Sutra 4 emphases, 'this hole is considered as the central point (*marman* or core): This is the third action. On this place on the stone panel, on both sides of the central hole, the *sthapakas* draw a double circle from different *bindus* on a line by joining them in the model of *Prakriti* and *Purusha*. That is the twin circle, by 'one' is meant that the two (circles) are on one line this should be noted.' It also states the form of the image which is based on a line diagram (*rekha-panjara*) is glorious. The next important sutra is the sixth, which states that the beginning of the circle is 'All' (universe) and emphasis the role of the *bindu*. 'The breath of life (*prana*) is (contained) in its form, even as the mind is in Man. The circle is Time, according to the *Vastuveda*. The movement of the circle is restricted (by its circumference), like the fluctuation of the mind. The support of circle is immortal;

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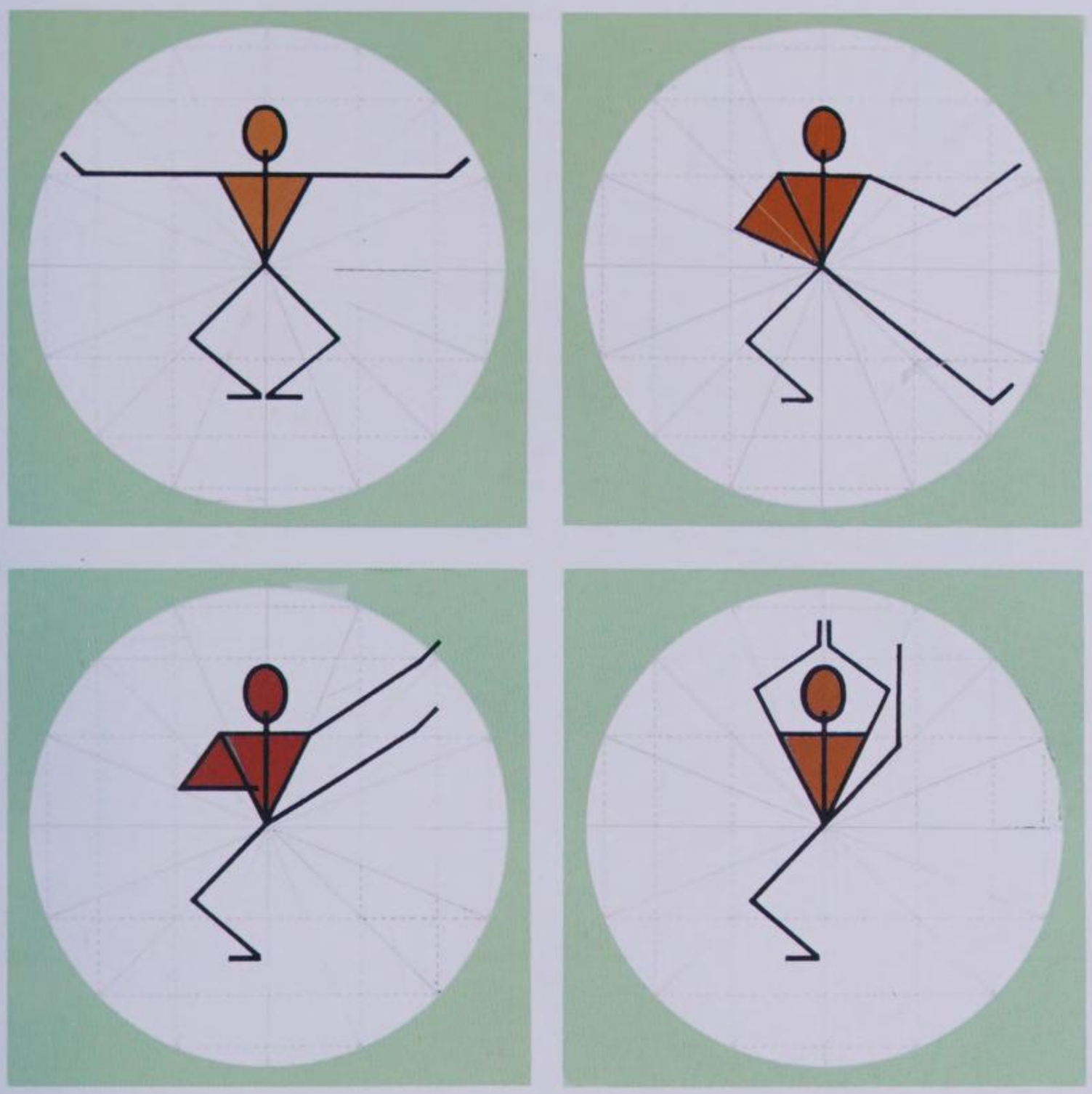
[14] Ibid. p 54, 'In the Kasyapa Samhita Silpasatra, 1st Adhyaya, it is said: "With a stick of yujuva wood encircled by a ring, having a rope of two musti with an iron point or peg at the end, that is the ghurnika (in function of a pair of compasses)

the *bindu* is its firm position (station) like the *Atman* (in man). He who knows this is the supreme Lord, the overseer, Union (yoga), he is intelligence (*kratu*), he is truth.' This description can also be read in the conjunction to the table of the eight *Vasus*. The importance of the support system of the *bindu* and the circle is extensified in the next Sutra 7, which also highlights the dynamic revolving characteristic of the circle it states, 'I consider the circle within the field to be the support. Just as all living beings revolve, thus many forms originate. That is the breath of life. The field has to be divided in order to obtain the limbs (or parts) of the image.' Once the circle has been drawn the next emphasis is to the straight lines, which are compared to the rays of light, which divide the circle (Sutra 8 & 9).

The sutra 10 relates to the start of the creation of the image from the navel. It is to be noted that the center point of the intersection line (Y'-Y') of the 2 circles can be considered as the point of the navel of the image/ temple. The Sutra 11 relates to the representation of the circle as light (*tejas*) while the square indicates water. 'The area is enclosed by four lines. Like a water-tank, so also the relief panel is a square. The *Vedas* show that the entire world including all its quarters follows the way of Prajapati (cosmic laws). Thus in the panel too that (cosmic) form is contained. Because of the repetition (of the cosmic laws) the student of *Vastu* place this (the square or rhombus) again inside the circle (even in the symbolic representation in the panel).' The Sutra 12 gives details about the two diagonals, which relate to the nature of wind. 'As from the contact of water and wind foam arises, again in the foam bubbles arise, thus when the square is joined with the diagonals that relief-field becomes active. This is the understanding of the diagonal (wind) lines.'[15] This is true because all the plans are laid out on the diagonals.

Sequence of the Square and the Circle

[15] The use of diagonal grid for temple structures has been brought to the fore front by another study by Alice Boner, 'Extracts from the *Silpasarini'*, in *Studies in Indian Temple Architecture*, ed. by Pramod Chandra, (New Delhi, American Institute of Indian Studies, 1975), pp.57-79.



Facing page
From left to right
Figure 4.1 Derivations from the Setting, Polishing Action and Tracing Action of a Sculptural Diagram.

Figure 4.2 Vocabulary of Natyasatra being reduced to a square and a circle. (Courtesy Kapila Vatsyayan, 'The Silpa-panjara', in The Square and the Circle of the Indian Arts, 2nd edn. (New Delhi, Abhinav Publication, 1997), pp. 103-42, (p.123)

Next step according to the *Vastusutra Upanishad* is the tracing of the *karnikaksetra* (rhombus) as the earth by the *sthapakas* as given in the Sutra 13. 'Then the *sthapakas* draw the rhombus, starting from the center, and they trace two centerlines within the circle, they are the vertical middle line (*madhyarekha*) and the horizontal middle line (*Madhya-prastharekha*). There they obtain four parts of the same measure, like the four continents of the earth. This is the conception (*bhavana*) of the earth-field.' Then goes on to describe the *bindu* in the center, as the 'life-breath of the earth' in the Sutra 14, which also thus summarizes the existence of the eight *Vasus* five elements in the tracing. To summarize the order of tracing we can refer to Fig.4.1.

4.2 Derivations from the Natyasastra

The temple terminology is largely derived from the human anatomy. Dhaky's contribution for the derivation of a detailed terminology is well recognized, its has been extensively applied in all the parts and volumes of The Encyclopedia of Indian Temple Architecture (New Delhi,American Institute of Indian Studies various

Previous Page Mahakaleshvara, Un, Madhya Pradesh

Above Shiva temple, Jamli, Dewas Distt, Dakshin Madhya Pradesh

parts in joint colaboration.)[16] Meister has analysed its use further.[17] According to Vatsyayan, "the *Silpasastra* reduced the body of Man to lines horizontal and vertical, and, like the *vyama* of *Satapatha* (X.2.2.6) began with the image of the standing man. The motifs (geometrical diagrams) they evolved were also the square and the circle. The measure was conditioned by the medium of expression: the standing man with his arms outstretched (rather than upstretched), recalling the Vedic description, 'he is as broad as he is high'. Within this square frame and the space of the circle a whole cosmos was contained, equating again the different parts of his limb and organs with different lines and intersections on one plane and the different elements of the universe on the other."[18]

Further study can be conducted, to make derivations which could be applicable to the temple architecture geometry, from the *Panjara* or *pinjara*. Its way of representing the reduced form of the physical body of man to an impersonalized design and also, from the vocabulary of *angas, upangas* and *pratyangas* in the *Natyasastra* as shown by Vatsyayan could prove fruitful (Fig.4.2).

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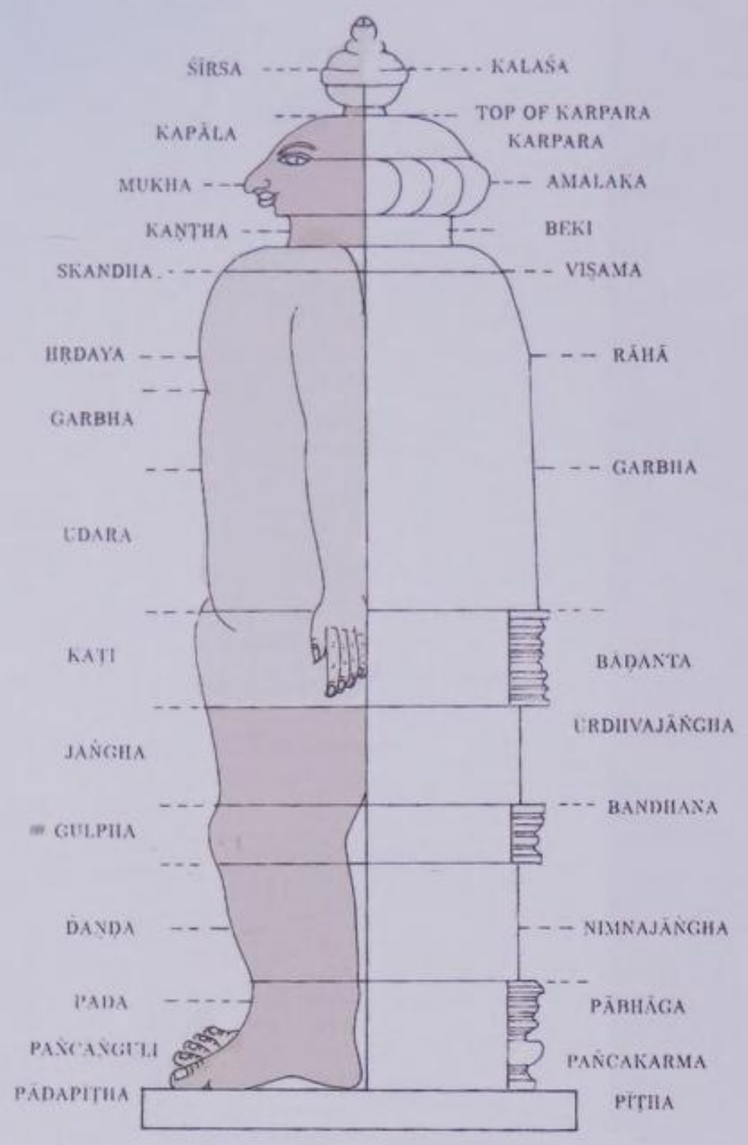
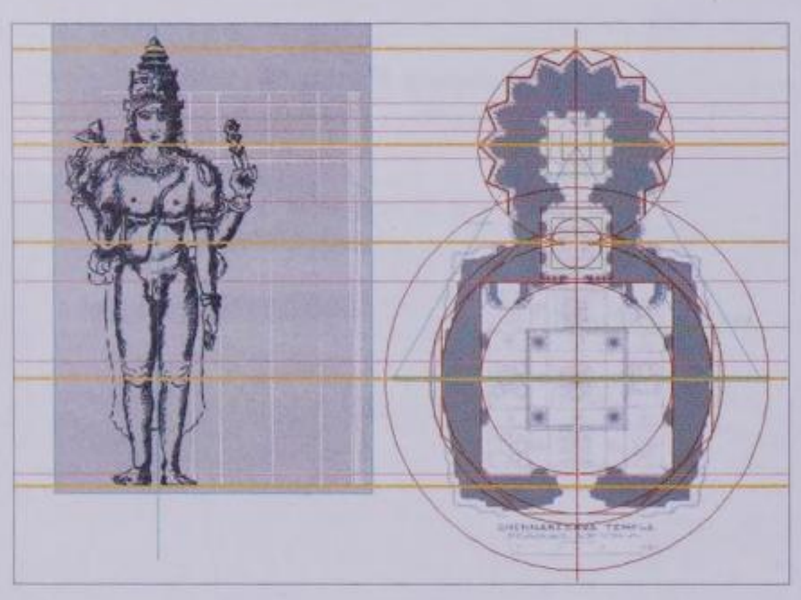
[17] 'Reading Monuments and Seeing Texts', in *Sastric Traditions in Indian Art*, ed. Anna Libera Dallapicola, Vol.I, 2 Vols, (Stuttgart, Steiner Verlag Wiesbaden, GMBH, 1989), pp. 167-73.

[18] Kapila Vatsyayan, 'The Silpa-panjara', in *The Square and the Circle of the Indian Arts*, 2nd edn. (New Delhi, Abhinav Publication, 1997), pp. 103-42, (p.103)





From top to bottom

Figure 4.3 Application of terminology and proportions of human anatomy to a temple elevation (courtesy Sthapaka Niranjana Mahapatra).

Figure 4.4 Proportions of '*purusha*' ('*purusha*' image courtesy Vatsyayan) as applied to Chennakesava temple, Nagalpura (Chennakeshva image courtesy Hardy).

Facing page South elevation, Nilakanthesvara temple, Un, Madhya Pradesh

4.3 Application of the proportions of Man (Purasha)

Another symbolic expression which was initiated by Kramrisch is the representation of temple structure to Man (*Purasha*). Since, any visual representation of the '*purusha*' in texts is missing, Kramrisch subsequently developed it into diagram '*vastupurushmandala*' having a grid and a man residing in it whose presence has not been proved in the temple plan or the elevation. None of the literary texts mention its presence. I feel that the whole thing is a big mix up. The texts like *RigVeda X, 90.5*, *Vastuvidhana, VIII.14* and *Samaranganasutradhara*, II.4 mention '*purusha*' as being part of the temple philosophy but not literally sitting inside a square. The grid has been mentioned with regards to the proportioning system only. Texts which are considered to be technical like *Silparatnakosa* (composed 1620 A.D.) according to Sthapaka Niranjana Mahapatra, do not elaborate on the theology of the *purusha*, but directly relate it to the *rekha* (Orissan) temple structure (Fig 4.3).

I have experimented with a similar application of the *purusha* proportions[19] to the Chennakesava temple plan. The line projected from the navel (*nabhisutra*) coincides with centre of the *anatarala*, the chin (*hanvagrasutra*) with the *garbhagriha* centre, and lower part of the knee (*janvadhassutra*) with the centre of the *mahamandapa* (Fig.4.4). It can be further investigated if there can be any similar literal application of the proportions of the human body to the temple plan as well as elevations. It would be interesting to note here that my experiments with the proportions of the female form did not yield any fruitful results[20].

Now, having established the SCS as an effective principle, the *Sri Yantra* is analysed as an ancient instrument and diagram.

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19 ibid.,Fig.42

20 ibid, Fig.43

5-An Analysis of Sri Yantra and its Application in Temple Architecture

5.1 Introduction to Sri Yantra

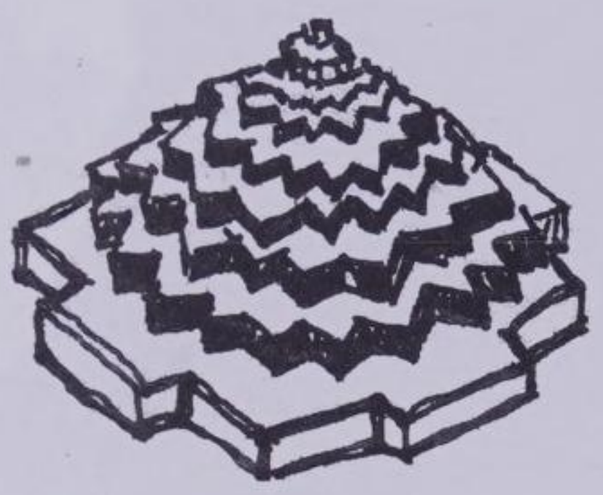

Figure 5.1 Sri Yantra: Meru form generally used for meditation

The *Sri Yantra* (Frontispiece) has been explained in some scholarly texts[21] with an assumption that the reader has sufficient experience in its constructional techniques and "expressions of a multi faceted, individual nexus of ideas transmitted by a symbolic code - aided only by a vague familiarity with their repertoire of forms and their thoughts without the advantage of precise evidence from the literary tradition"[22] and hence are an insufficient source of information for the uninitiated to even draw a correct diagram of this linear *yantra* and further analyse its structure and application (Fig.5.1). Although some interest to study its artistic form and development has been initiated after Arthur Avalon's,[23] published texts with an analytical introduction, it is still to many a people just an image involving triangles.

I am taking forward Zimmer's initiative to simplify the *Sri Yantra*'s construction and elaborate its developmental steps from a '*bindu*' to its final 14-point complex star form. Another objective is to find any justification in Mahapatra's reference of the Orissan Manjushri[24] temple type as a *Sri Yantra*.[25]

Although Mahapatra's contribution to the study is note worthy but it raises a few important questions like what is the exact placement of the *Sri*

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[21] *Nityasodasikarnava* and also *Tantraraja Tantra,* Part I, edited by Mahamahopadhyaya Laksmana Sastri, Tantric Texts, VIII (London 1908). Also see *Prapancasara Tantra* for brief references.

[22] Heinrich Zimmer, *Artistic Form & Yoga in the Sacred Images of India*, trans. from the German by Gerald Chapple & James B. Lawson, (Delhi, Oxford University Press, 1984), pp. 158-180, (p.159)

[23] Sir John Woodroffe (pen name Arthur Avalon, q.v.), *The garland of Letters, Studies in the mantra-shastra*, Madras 1952

[24] An Orissan temple type: "the beautiful temple of *Sri* (*Shakti*)", based on the Sri Yantra.

[25] Sthapaka Niranjana Mahapatra, *Silparatnakosa,* sanskrit text ed. and translated by Bettina Baumer and Rajendra Prasad Das, general ed. Kapila Vatsyayan (New Delhi, IGNCA and Motilal Banarsidas Publishers Pvt. Ltd., 1994), pp.5-10, 149-59

Yantra on the temple plan? And what are the final results? We had taken a look at the placement of the *Sri Yantra* and its possible derivations in plans in the various chapters. The reason why the *Sri Yantra* has never been successfully applied to the temple plan and elevation is because the *yantra* diagrams drawn and published have little if no resemblance to the actual temple plans. That is why Mahapatra's has basically superimposed the complete *yantra* on the Rajarani temple plan without any thought. The drawing in its current form does not show any possibilities of any derivations of the yantra for the plan (Fig.5.2)

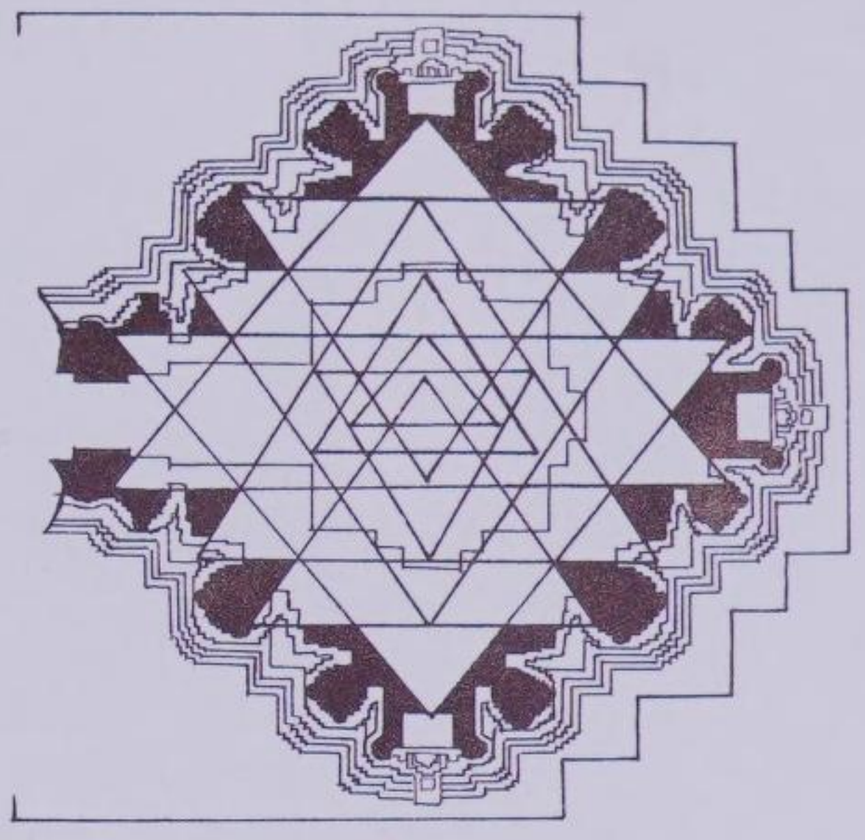

Figure 5.2 The charkas and konas of the Sri Yantra superimposed on the plan of Rajarani temple, Bhubaneshwar (courtesy, Sthapaka Niranjana Mahapatra, Silparatnakosa, (New Delhi, IGNCA and Motilal Banarsidas Publishers Pvt. Ltd., 1994), p. 152, Fig. 56.

This part of the study focuses on finding the correct way to locate the *Sri Yantra* besides attempting to find out how extensively the *Sri Yantra* can be applied to the North Indian temples. In order to conduct this analysis firstly the *Sri Yantra* has to be drafted correctly and then it should be tested on various temples irrespective of their type. Although many drawings both ancient and modern exist hardly any is suitable enough for a precise analytical exercise for this kind which involves high precision.

5.2 Sri Yantra as a Tantric Symbol

Since the architecture of the ancient temples unfortunately is largely based on oral traditions[26] some of the suggested parameters of its planning could be over or under amplified viz. the *mandala* which is a basic grid pattern also used as a sacred diagram for performance of religious rites developed into a *vastu purush mandala* which now without a proper analytical test is popularly believed to be the governing diagram for all the temples. Whereas in the case of the *SriYantra* its strong *tantric* connotations has made most of people dismiss it as incomprehensionable but an unusually potent and powerful geometric composition popularly used by the aspirants (*sadhaka*) for meditation activities for gaining higher

[26] Inaugural address, Kapila Vatsyayan, Shastic traditions in Indian Art, ed. Anna Libera Dallapicola, Vol.1, pp1-4, 1989.

levels of spiritual power. Mookerjee[27] and Khanna[28] have studied the *yantra's* metaphysics and dynamics both in its ritual and meditation form in detail and briefly its application in temples too.[29] Rawson relates the *yantra* to *mantra* and defines "the function of the yantra in the sphere of sound. As mantra is a nucleus of sound by means of which cosmic and bodily forces are concentrated into ritual, so *yantra* is a nucleus of the visible and knowable, a linked diagram of lines by means of which visualized energies are concentrated. Mantra and *yantra* complement each other, and are used in conjunction."[30] He goes to the extent of suggesting that the Hindu temples themselves are *yantras*[31]. There is a need to further explore a much larger possibility of *Sri Yantra's* role as a design parameter for the Hindu temple architecture, which is primarily based on the traditional system.

Previous Page:
Garbhagriha door frame, Vishnu temple1, Sacchiyamata temle, Osian, Jodhpur, Rajasthan, courtesy Hardy

5.3 Sriyantra and its two types

Although the basic governing principle of both the types is the same, the final result is quite different. Looking at the *Sri Yantras* in Figs. 5.3 - 5.4, they apparently look the same. But they are quite different. The *Sri Yantra* in Fig.5.3 is the one used for meditation purposes which can be encased in a circle and a square. The one demonstrated in Fig. 5.4 if drafted correctly, is applicable for temple design and planning.

Now, I would highlight the differences between the two. In the first *Sri Yantra*, the angle of the enclosed triangles is varying dramatically (Fig.5.5). In Fig. 5.5-.5.6 we can note the angles of the triangles as 129°, 117°, 120° and 126°... Therefore the lines of the triangles are not parallel to each other. The main reason for this variation is that the points 'm', 'n' and all the other similar apex points of the inverted triangles are touching the bases of the straight triangles. Where as in the other case (Fig. 5.7, incorrect drafting of this diagram has resulted in some errors) the angles of the triangle are tending to be the same. In principle they should be the same. All the triangles used for constructing the *Sri Yantra* are

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[27] Ajit Mookerjee, *Ritual Art of India*, (London, Thames and Hudson, 1985), pp. (p.) Ajit Mookerjee and Madhu Khanna, *The Tantric Way*, (London, Thames and Hudson, 2003), first published in The United Kingdom in 1977) pp. (p.)

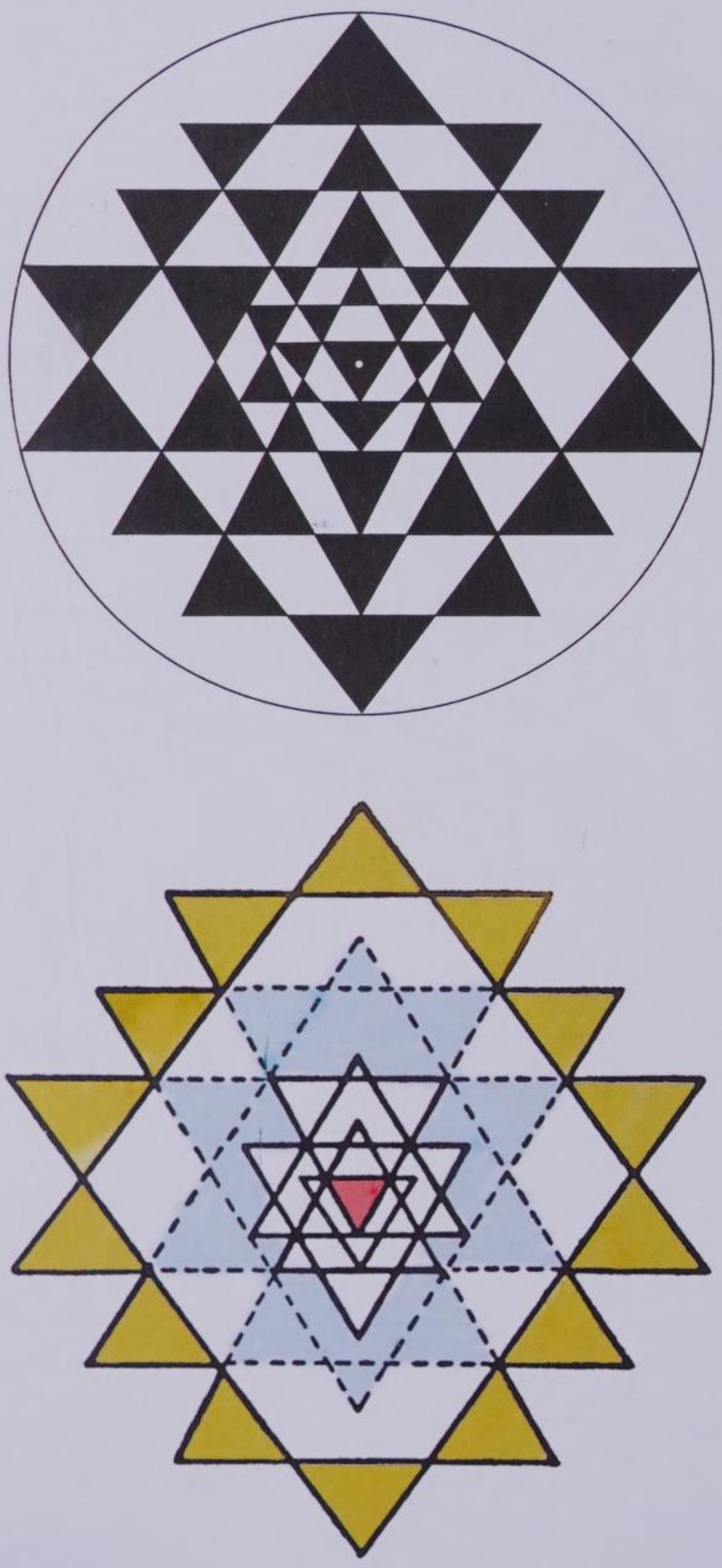
[28] Madhu Khanna, Yantra*: The Tantric Symbol of Cosmic Unity*, 2nd edn (London, Thames and Hudson, 2003)

29 Khanna, 2003, pp. 143-68

[30] Philip Rawson, *The Art of Tantra*, 3rd edn (London, Thames and Hudson, 1995), p.66

From top to bottom
Figure 5.3 The Sri Yantra used for meditation purposes which can be encased in a circle and a square.

Figure 5.4 The Sri Yantra applicable for temple design and planning.



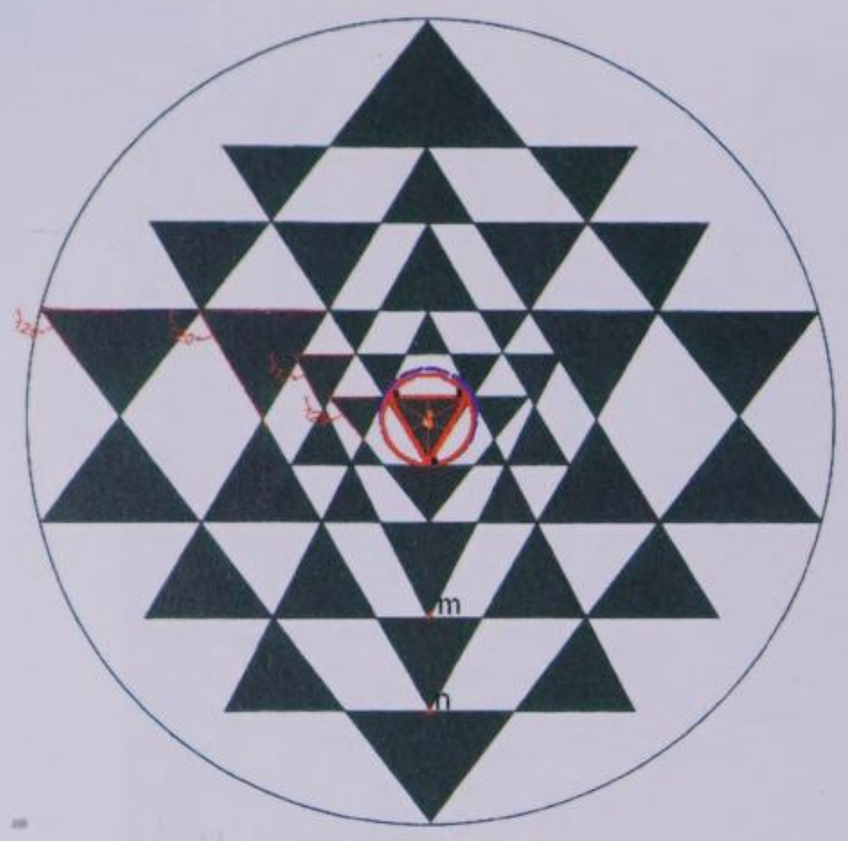
equilateral triangle and hence should have their enclosed angles as 60°. In Figs. 5.6-5.7 we can not say that just incorrect drawing has resulted in similar angles 56°, 57°, 58° and 54°. This can only be achieved if the points 'm' and 'n' do not touch the bases of the straight triangles (Fig. 5.8) and the sides of the triangles remain parallel to each other.

The possibility that the first type of *Sri Yantra* has been used for temples is low because, a temple plan is based on symmetry. The plan's orthogonal characteristic is maintained at all times and therefore the diagonal grids can also be applied successfully. Hence, under these considerations the second type of the *Sriyantra* which maintains its parallel lines at all time was adopted for this study. Its method of construction has been shown step by step and its application has been studied for varied temple plans. The derivations from this study are quite visibly convincing. Although the initial construction method is same in both the methods the final products are different (Figs. 5.9-5.10). Hence, the *Sri Yantra* that is applicable for the temple studies is elongated and rectangular in shape (Fig. 5.11).

5.4 Locating the Sri-Yantra

Unlike Mahapatra's diagram of Rajarani (Fig.5.12) the complete *Yantra* is not placed on the *garbhagriha* until and unless we equate the 16 petals of the *Sri Yantra* to the 16 pointed

Shiv temple, Bilokala, Shivpuri, Madhya Pradesh



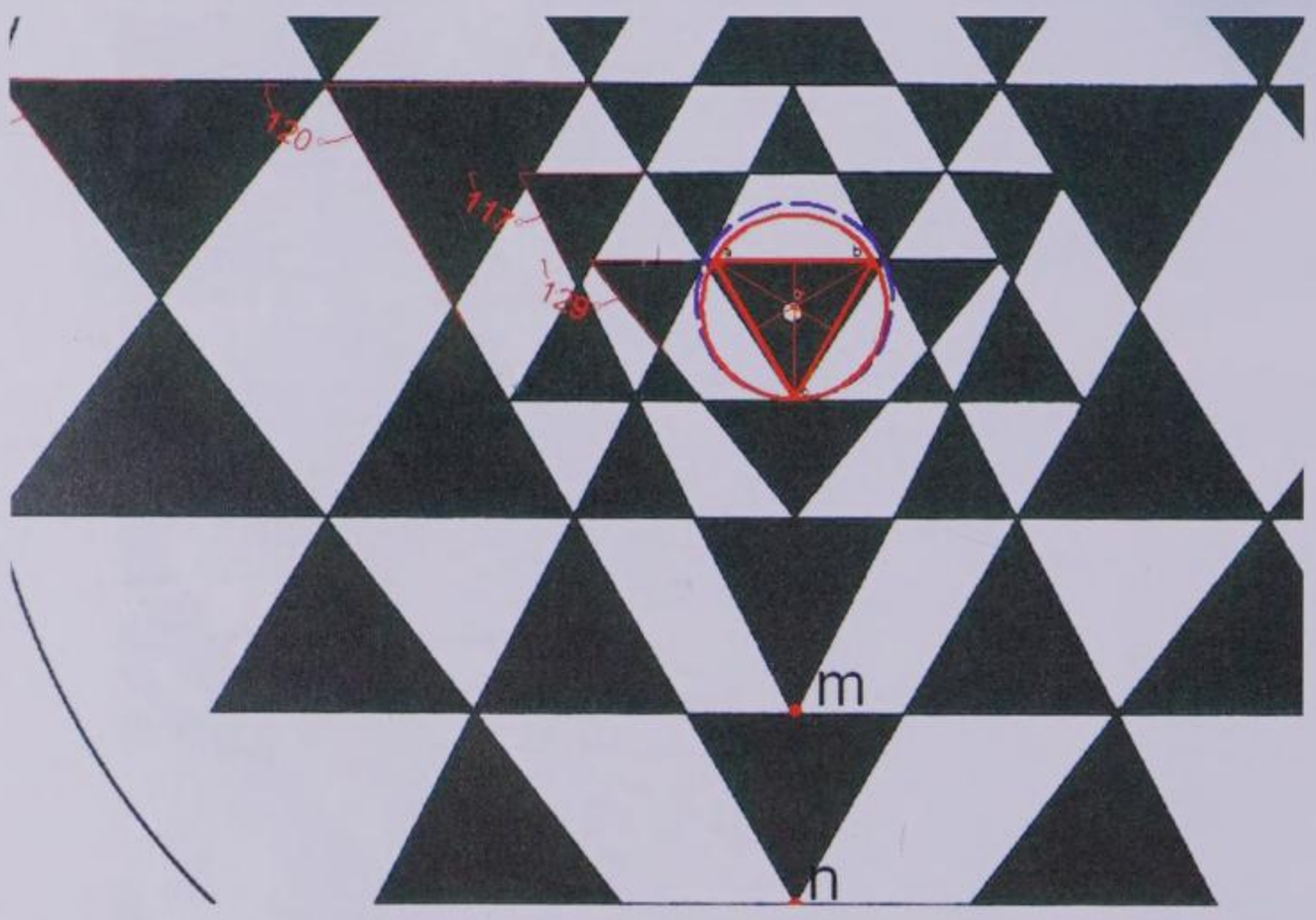
From top to bottom

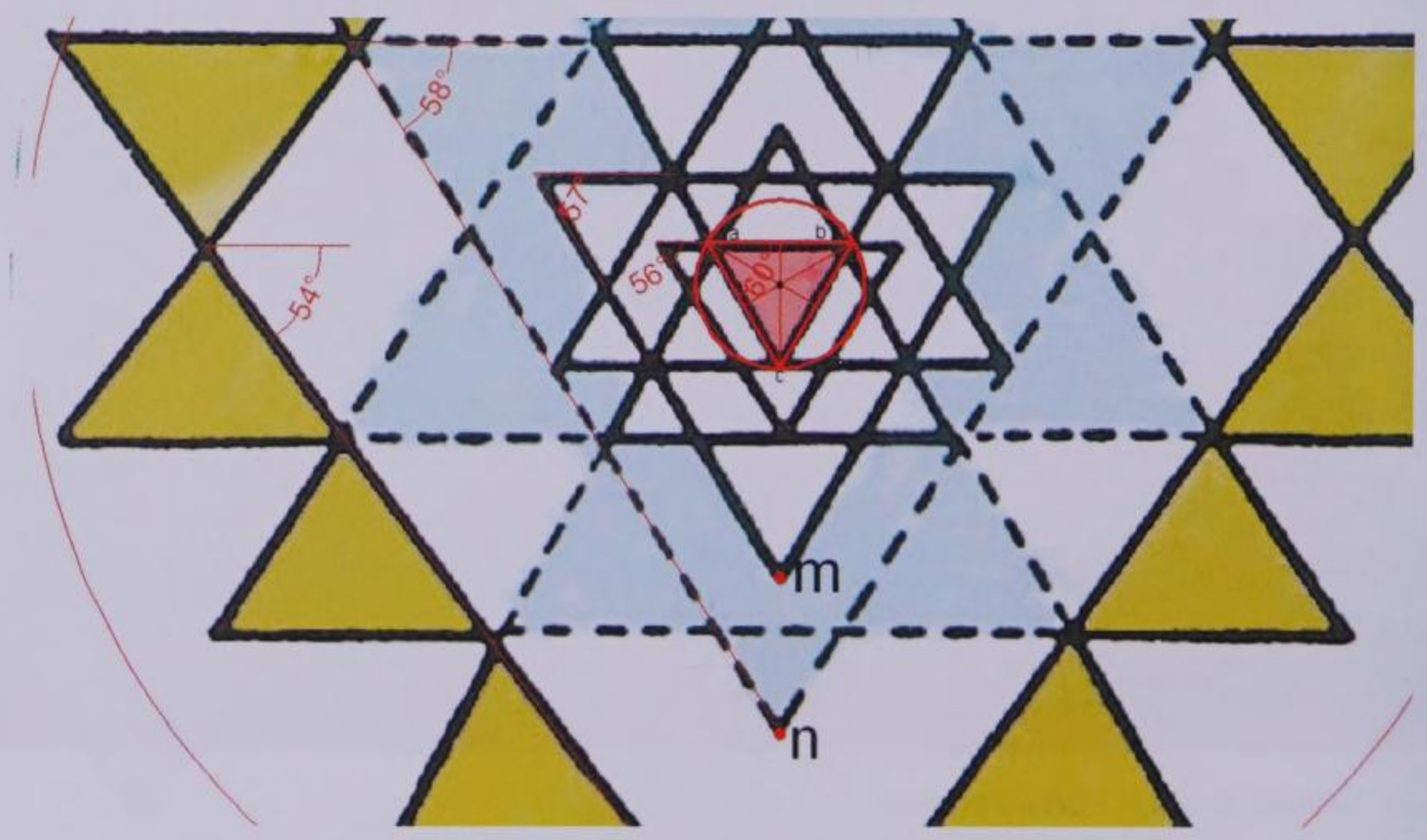
Figure 5.5 Sri Yantra, the angle of the enclosed triangles varying dramatically. Apexes of all the inverted triangles touch the bases of closest upright triangle, point 'm' and 'n'.

Figure 5.6 The triangles inside this Sri Yantra have variations (129°, 117°, 120°, 126°...) in their angles.

Figure 5.7 Sri Yantra, slight variation in the angle of the enclosed triangles accounting due to errors in drafting. Apexes of the inverted triangles do not touch the bases of closest upright triangle, point 'm' and 'n'.

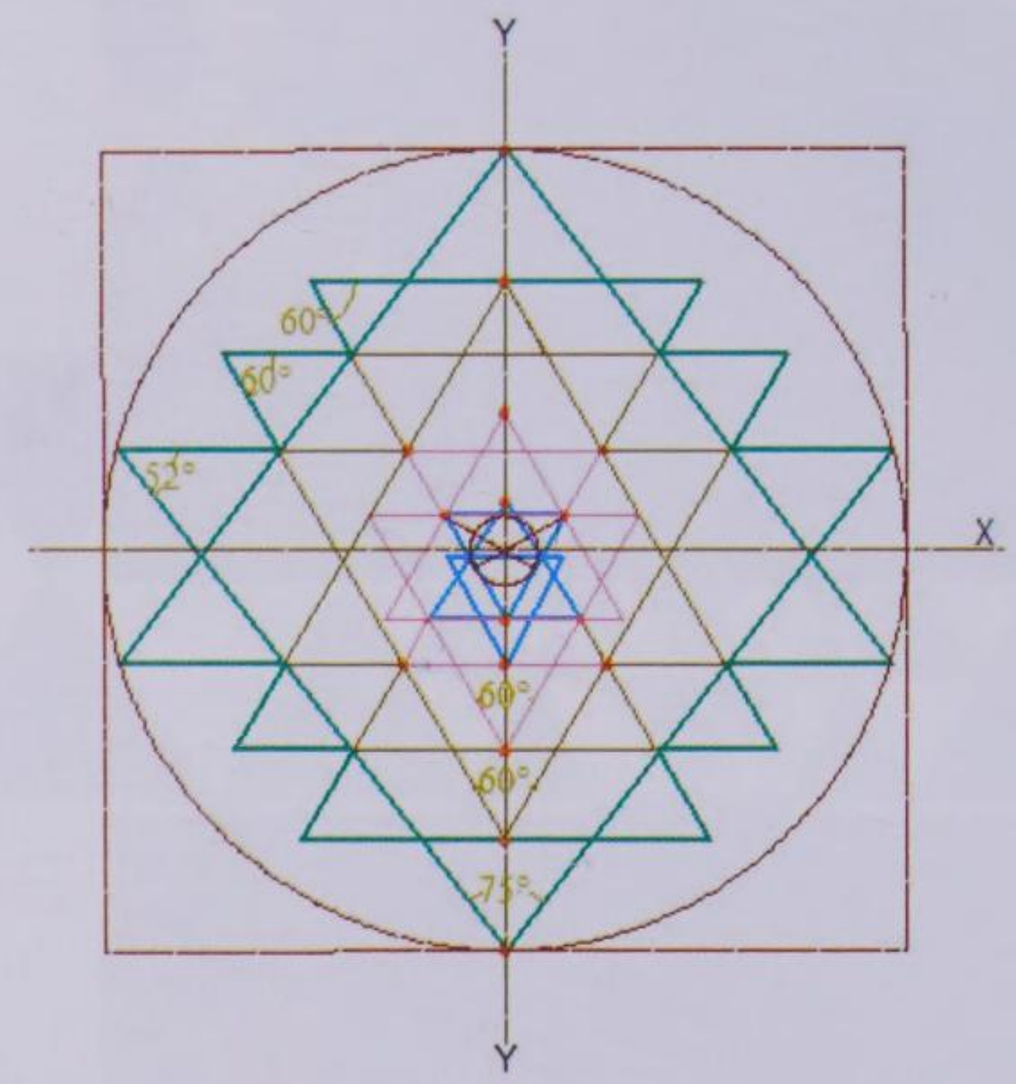
Figure 5.8 The triangles inside this Sri Yantra have slight variations in their angles.

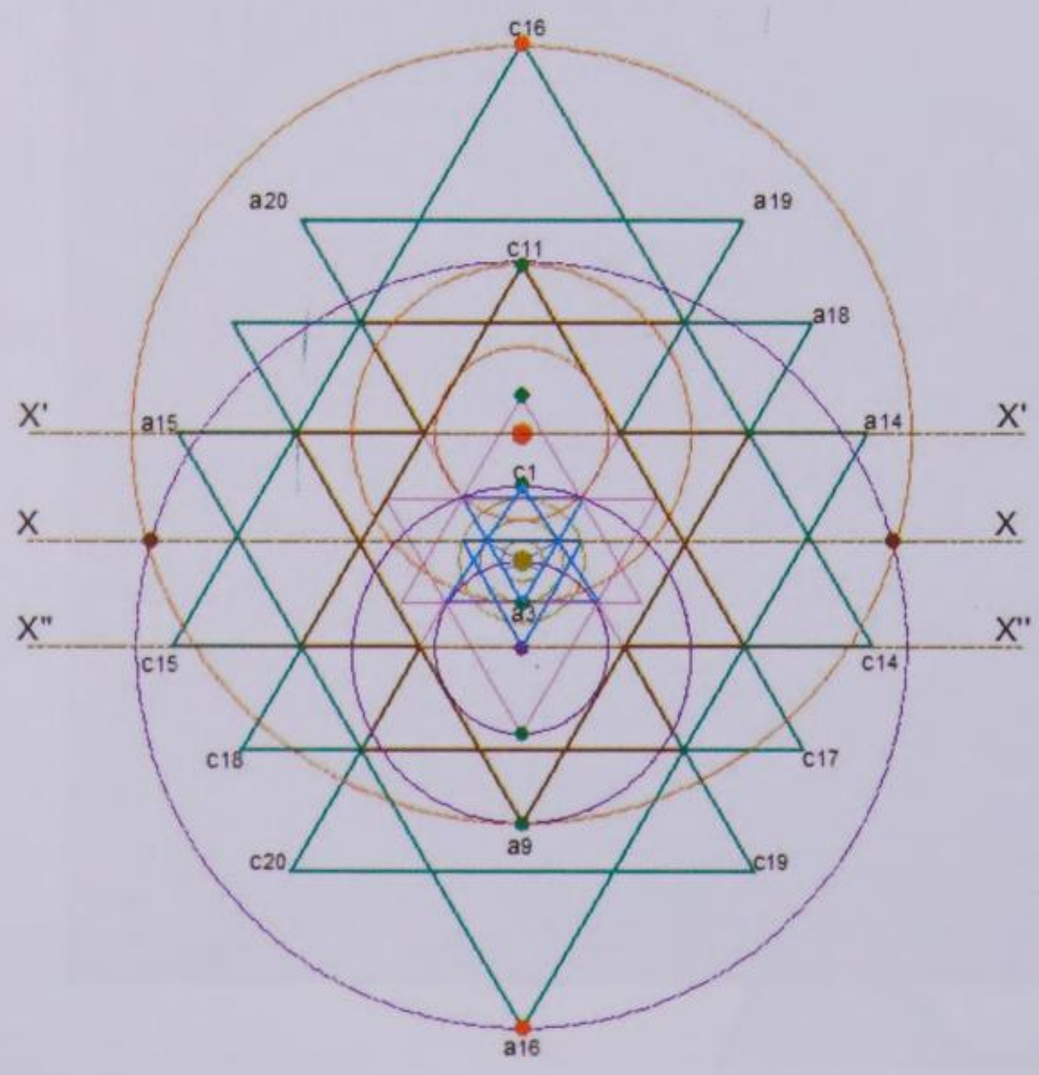




Ceiling detail, Sander Sunak, Gujarat, courtesy Hardy

Ceiling detail, Mukhamandapa, Temple 2, Survaya, Madhya Pradesh





From top to bottom
Figure 5.9 The *Sri Yantra*, properly drafted *ri Yantra* showing that the apexes of the inverted triangles which do not touch the bases of closest upright triangle will be used for temple design.

Figure 5.10 Correctly drafted *Sri Yantra* used for meditation.

Figure 5.11 Complete, correctly drafted *Sri Yantra* used for temple design.

star shape of the SCS.[32] Instead the complete *Yantra* is placed on the complete length of the temple along the longitudinal axis starting at the *mukhamandapa* entrance and terminating at extreme end point of the central *bhadra* of the *prasada* (Fig. 5.13).

On placing the *Sri Yantra* on the plans and elevations correctly, some astonishing results can be recorded and it can be said for definite that the *Sri Yantra* plays a crucial role in the placement and location of the various important points on the plan as well as the elevation (Figs.5.13 - 5.14).

5.5 Possible Derivations from the Sri Yantra's 16 petals

There is no doubt that the figure '16' holds the key to most of the locations on the plan

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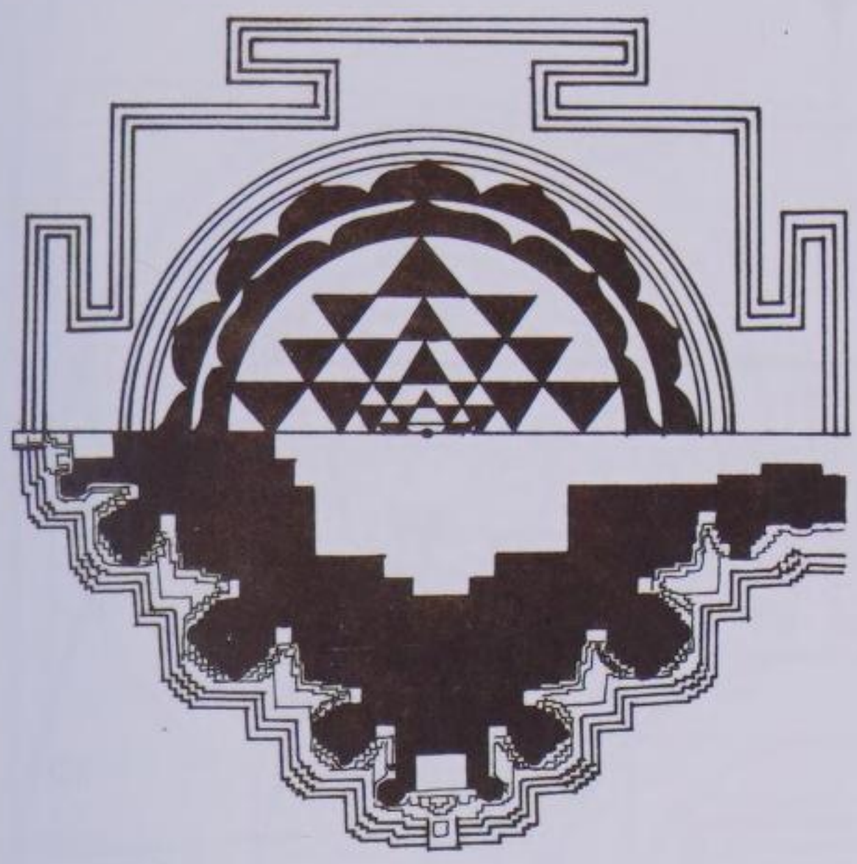
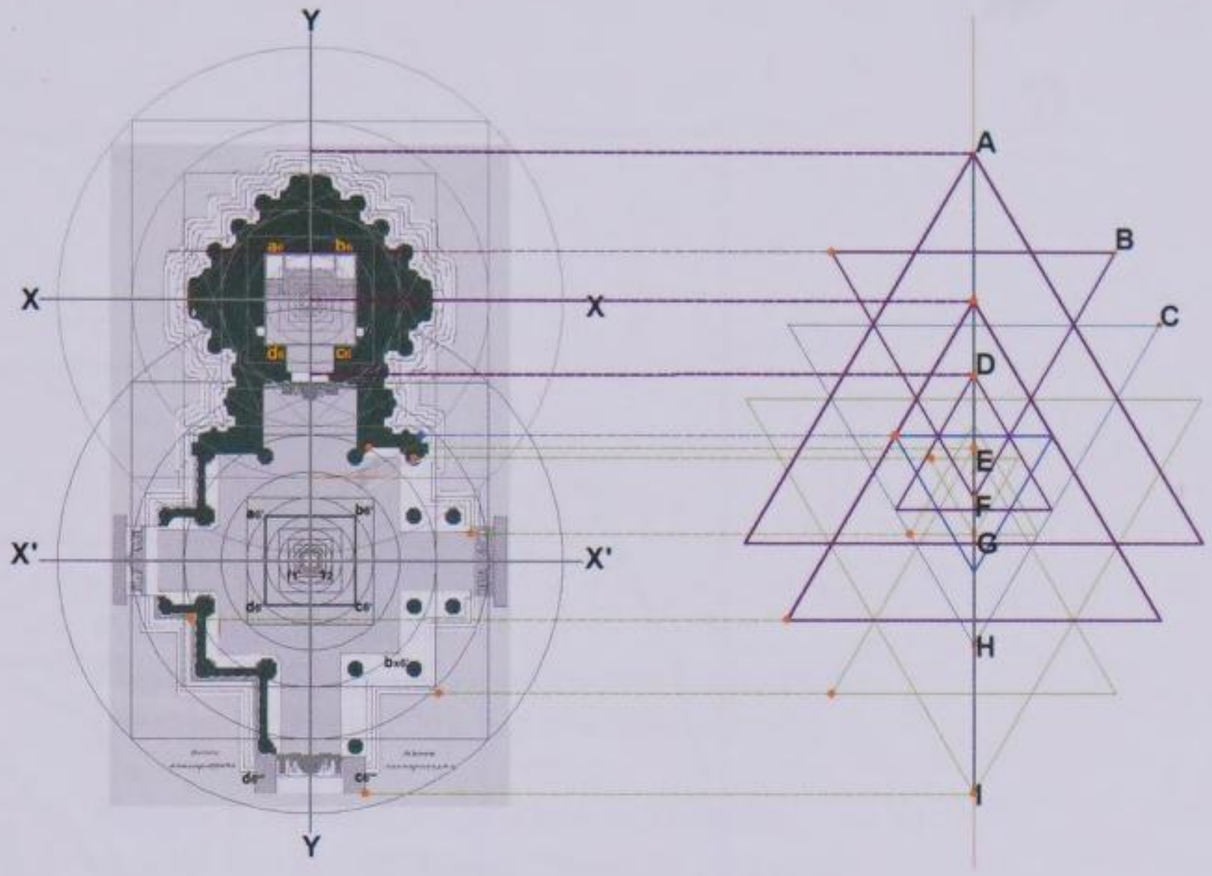
[32] ibid. pp. 148-52, frankly, the Fig. 53-6 just show a Sri Yantra superimposed on to the plan of the Rajarani temple and it definitely does not show any thing substantial. Although what can be derived from these figures is conceiving 16 petals as the 16- pointed star of the Square-Circle-Sequence of the plan geometry which is instrumental in deciding the locations of the smallest of the offsets in the plan. The use of the 16 pointed star or petal has been shown extensively in the chapter on geometry and *rekha*.



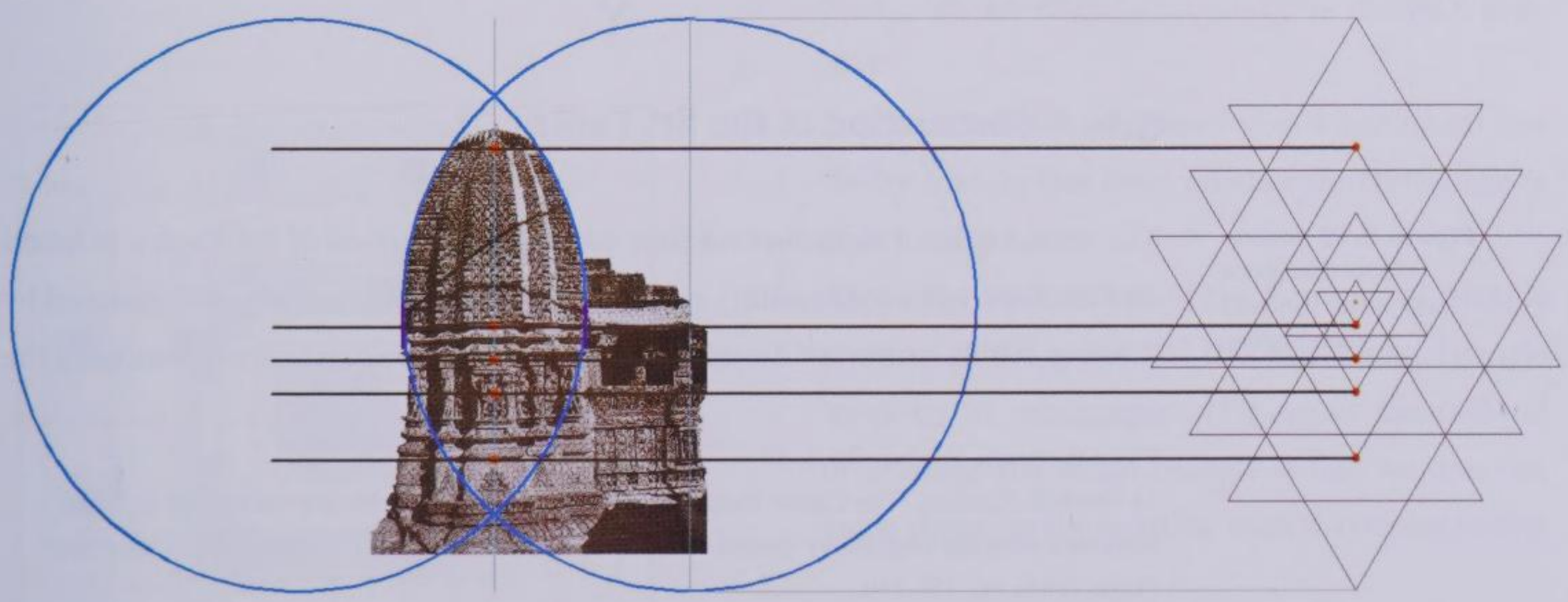


(Figs.5.16-5.18). In majority of the cases except Lakshmikanth temple, Jaisalmer (Rajasthan), Bahu temple, Nagad (Rajasthan) and a few others, the *garbhagriha* actually does not coincide with any of the squares of the Square-Circle-Sequence (Fig. 5.15) but is generated from the rotated square to 22.5° angle which results in a figure having 16 points.

Clockwise from left top
Figure 5.12 Part *Sri Yantra* with the part Rajarani temple plan (courtesy Mahapatra, 1994, p. 151, Fig. 54).

Figure 5.13 Placement of the *Sri Yantra*, for derivation of key locations on plan (ref. Ch.3).

Figure 5.14 Placement of the *Sri yantra* for derivation of key locations on elevation, (ref. Ch. 3).



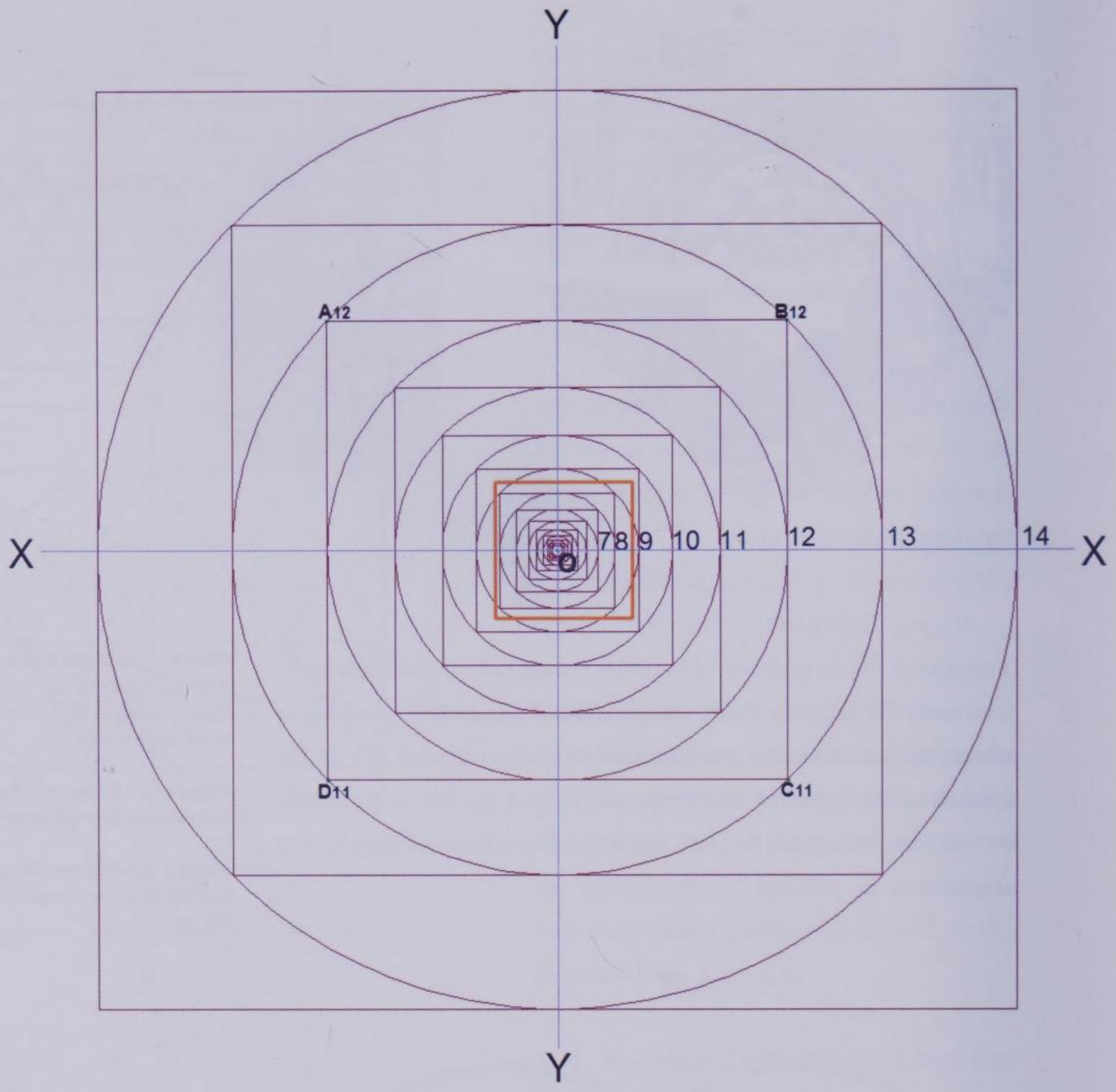


Figure 5.15 Square-Circle- Sequence with an off centered *garbhagriha.*

5.6 Construction of the Sri Yantra

The method that I am adopting here for the construction of Sri Yantra is based on Bhaskararaya's commentary on the *Nityashodashikarnava*,[33] as mentioned by Zimmer.[34] Bhaskararaya[35] describes *Nityashodashikarnava* text as a portion of the

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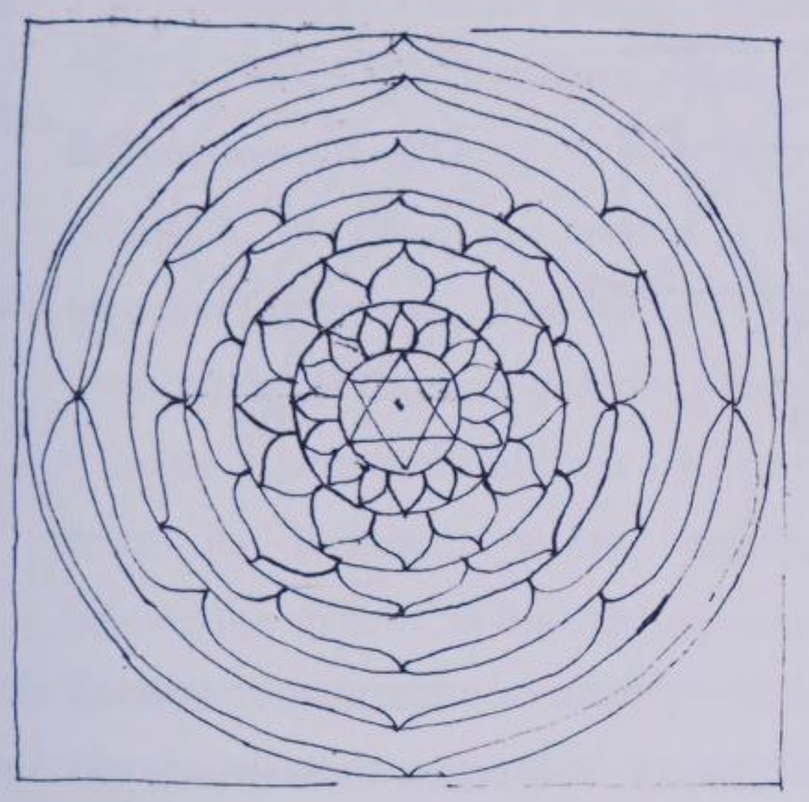
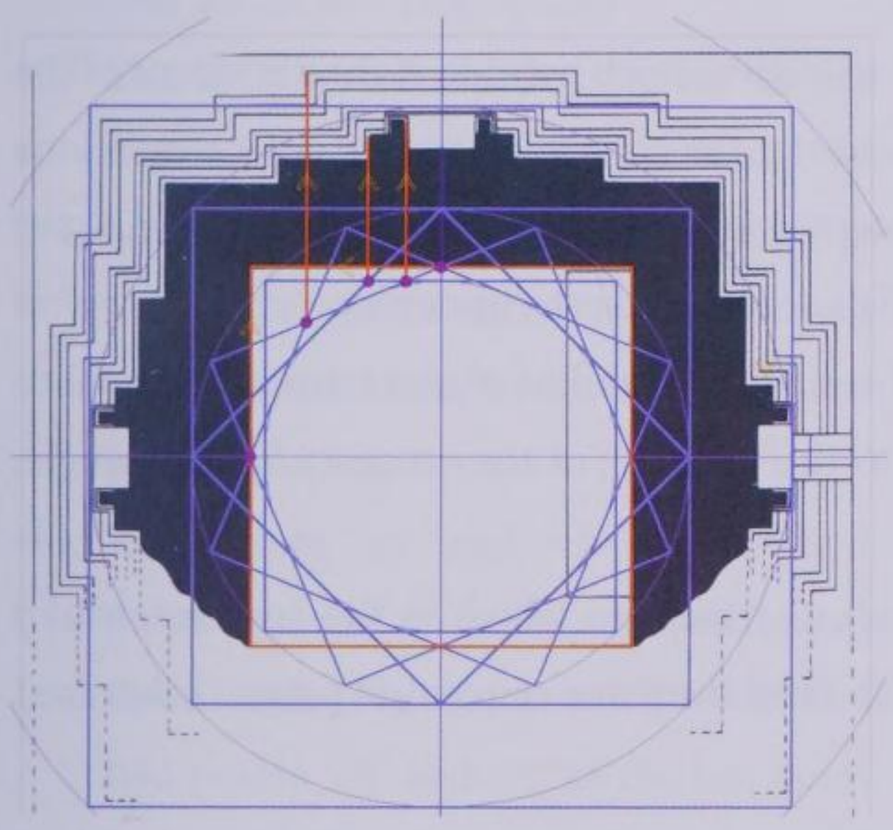
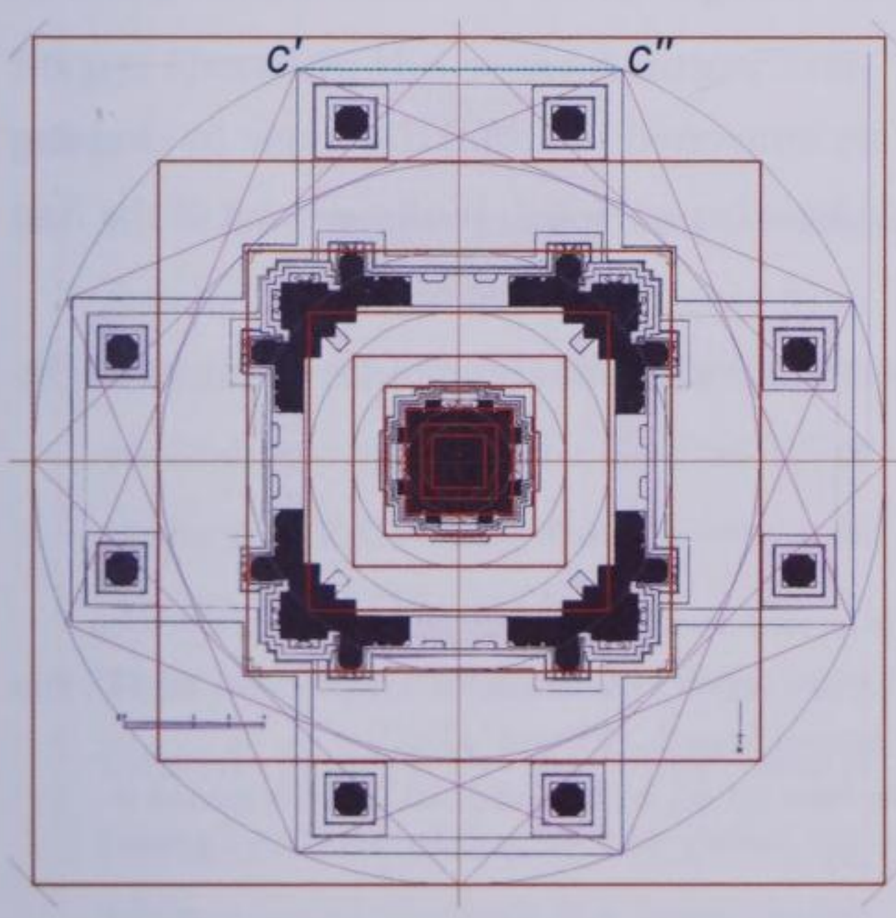
[33] Bhaskararaya, Setubandha, I, 42.

34 Heinrich Zimmer, 'The Linear Yantra', *Artistic Form & Yoga in the Sacred Images of India*, translated from the German by Gerald Chapple & James B. Lawson, (Delhi., Oxford University Press, 1984), pp. 158-180.

[35] Bhaskararaya, a famous commentator on Tantra and Upanishad texts; lived in the first half of the eighteenth century. A few of the famous tantric texts he commented on were *Vamakeshvara Tantra* (second portion of *Nityashodashikarnava*) and *Yoginihridya*, are published as the 56th Vol. of Poona Anandashrama Series.







From top to bottom
Figure 5.16 Nitya Nitya yantra with the 16 petals (courtesy Khanna, 2003, 1st print 1981, Fig.42)

Figure 5.17 Maniyamama temple Dedadara, Gujarat, c. A.D. 925, Square rotated to a 16 point star shape generate intersection points which on being projected yield location of points on the plan, (ref. Ch.3)

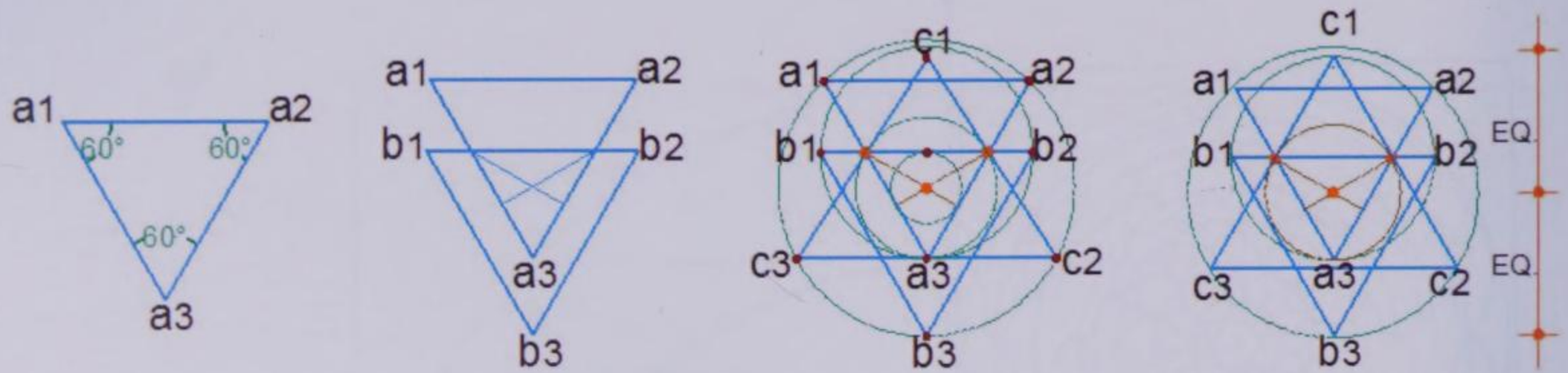
Figure 5.18 Jaina temple, Banpur, Madhya Pradesh, ca. A.D. 900-925, Joining of points on the 16- pointed rotated square, yield important edge point 'c′ -c′′', (ref. Ch. 3).

great *Vamakeshvara Tantra*. The *Nityashodashikarnava* steps of construction of the *Sri Yantra* are as follows:

Step1: Drawing the point, the triangle and the eight-point figure

i. First a *shakti* triangle 'a1-a2-a3' is drawn.[36] (Fig. A.1)
ii. It is bisected half way down with a horizontal line 'b1-b2' and on this form another *shakti* triangle is drawn. (Fig. A.2)[37]
iii. Above the base 'a1-a2' of the first *shakti* triangle starting at the point 'c1' the first *vahni* triangle 'c1-c2-c3' is constructed. (Fig.A.3.a) the method of drawing this *vahni* triangle is that we draw an angle (*kona*) at the point 'c1' such that its extending

[36] All the internal angles of the triangle are 60°s.
[37] It is important to note that a small *shakti* triangle is formed within the two *shakti* triangles with a nucleus formed which is equidistant from the points 'b1', 'b2' and 'a3'.



From left to right
Figure A1, A2, A3.a, A3.b

straight lines (*samdhis*) 'c1-c2' and 'c1-c3' form intersections (*marman*) with the sides 'a1-a3', 'a2-a3', 'b1-b3'and 'b2-b3' of the two *shakti* triangles. Also important is that the base 'c2-c3' of the *vahni* triangle touches the apex 'a3' of the first *shakti* triangle 'a1-a2-a3'.

iv. This creates a figure having eight triangles which point in eight directions of the compass and the ninth triangles lies in the center. There are six intersections of two straight lines[38] and two intersections of three straight lines[39] (Fig.A.3.a) Also it can be observed that the distance between the apex point 'c1' of the *vahni* triangle and the nucleus formed inside the smallest *shakti* triangle is equal to the distance from this nucleus to the apex 'b3'of the second *shakti* triangle. (Fig.A.3.b)

v. Now we have the point (nucleus), the triangle which is the smallest *shakti* triangle and the eight- point which form the three concentric figures (*charkas*)

Step2: Drawing the first ten-point

i. The base 'a1-a2' of the first *shakti* triangle 'a1-a2-a3' is extended beyond to points 'a4' and 'a5'.(Fig. B.1.a)

ii. Further the points 'a4' and 'a5' are converted to a *shakti* triangle by drawing the *kona* 'a4-a6-a5'. The extended lines 'a4-a6' touch the base point of the first *vahni* triangle at 'c3'.

iii. Similarly the other extended line 'a5-a6' will pass through the point 'c2'. (Fig. B.1.b)

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[38] The six intersections are: First intersection is formed from lines 'a1-a2' and 'c1-c3', the second from 'a1-a2' and 'c1-c2', the third from 'b1-b3' and 'c1-c3', the fourth from 'b1-b2' and 'c1-c2', the fifth from 'c3-c2' and 'b1-b3' and the sixth is formed from 'b2-b3' and 'c3-c2'.

[39] The first such intersection is formed from the lines 'a1-a3, b1-b2 and c1-c3' and the second is formed from the lines 'a2-a3, b1-b2 and c1-c2'.

iv. The third *shakti* triangle points 'a4','a5' and 'a6' forms the first three points of the ten point.

v. Similarly, we draw the second *vahni* triangle 'c6-c5-c4'. (Fig. B.2.b) The base 'c3-c2' of the first *yahni* 'c1-c2-c3' triangle is extended and lines are drawn from its terminal points, meeting beyond the apex 'c1' of the existing *vahni* triangle. (Fig. B.2.b)

vi. The fourth shakti triangle 'a3-a7-a8' is drawn by extending the points 'a1' to 'a7' and 'a2' to 'a8'. (Fig. B.3.b)

vii. The location of the line 'a7-a8' is not mentioned by Bhaskararaya should be where the distance between the line 'b1-b2' and 'a7-a8' is equal to the distance between the lines 'b1-b2' and and the point 'b3'. (Fig. B.3.a)

viii. The points 'c3' and 'c2' of the first *vahni* triangle 'c1-c2-c3' when extended downwards,(Fig. B.4.a) will give the last two points 'c8' and 'c7' of the ten point figure. (Fig. B.4.b)

Step3: Drawing the second larger ten-point

ix. By following the same steps we can develop the larger ten-point figure from the smaller. The larger ten-point figure is created by expanding the base 'a6-a7' of the uppermost *shakti* triangle outwards 'a11' and a10'. (Fig. C.1.b)

x. Then the two remaining sides are formed parallel to the other *shakti* triangles, terminating at the point 'a9' while passing through the lower *vahni*

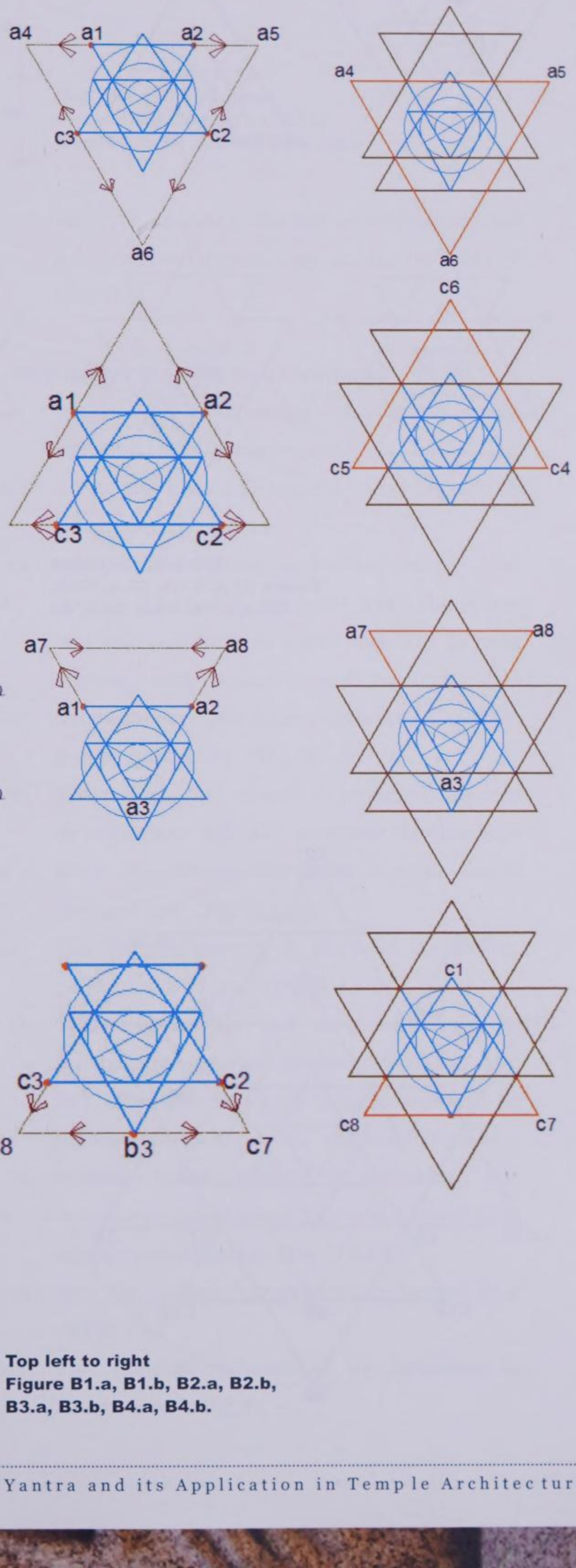

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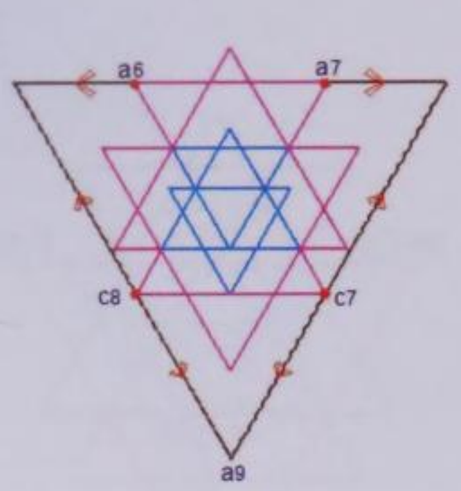
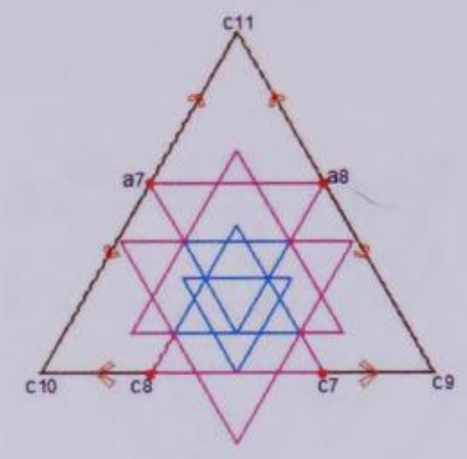
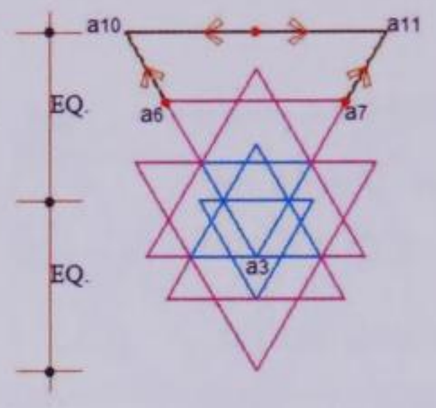
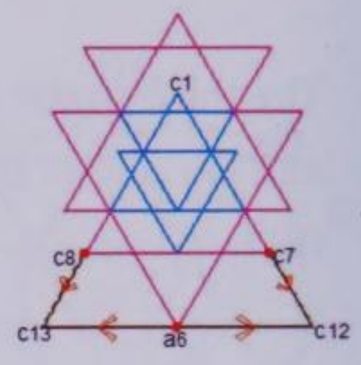
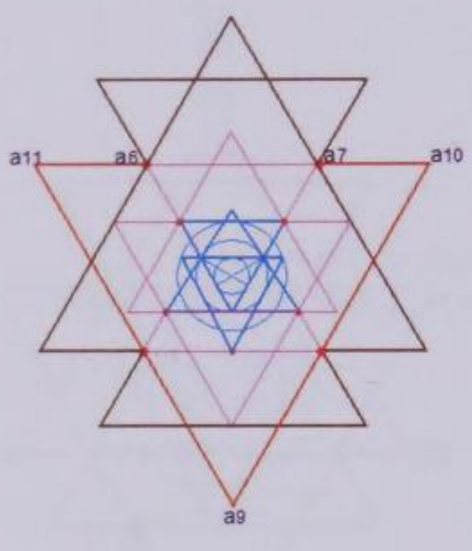
Figure B1.a, B1.b, B2.a, B2.b, B3.a, B3.b, B4.a, B4.b.











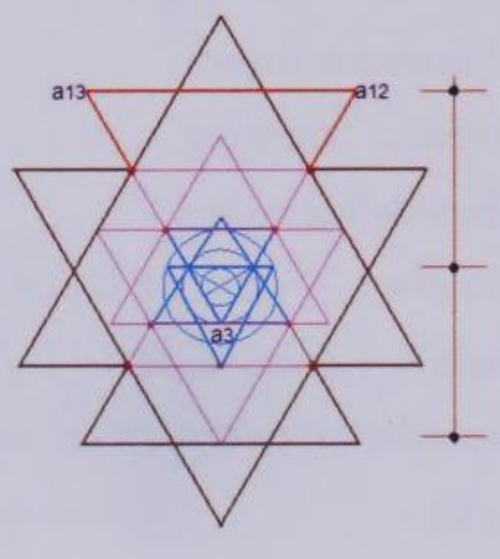


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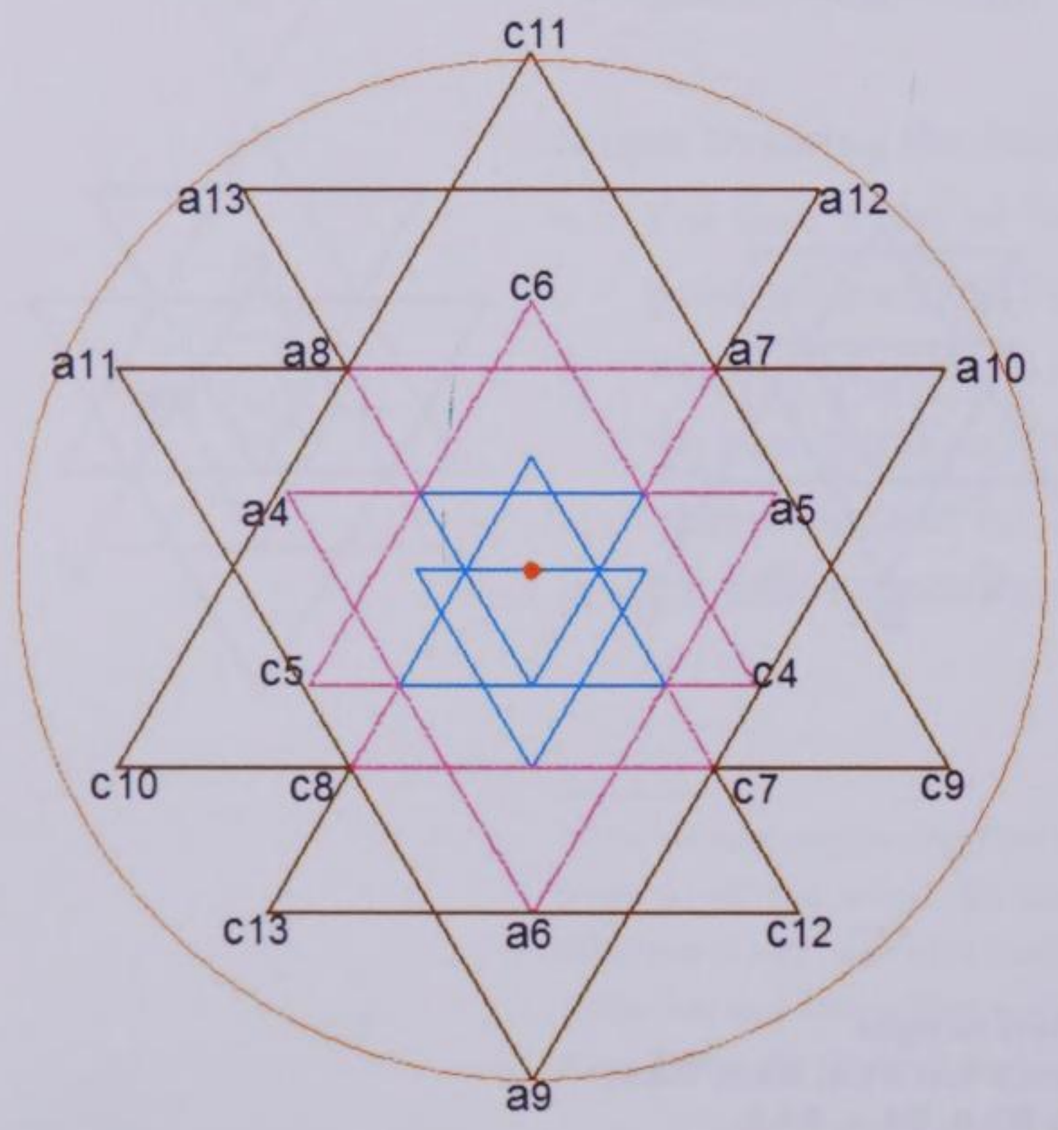
Figure C1.a, C1.b, C2.a, C2.b, C3.a, C3.b, C4.a, C4.b, C5



triangle's base points 'c8' and 'c7'. (Fig. C.1.a)

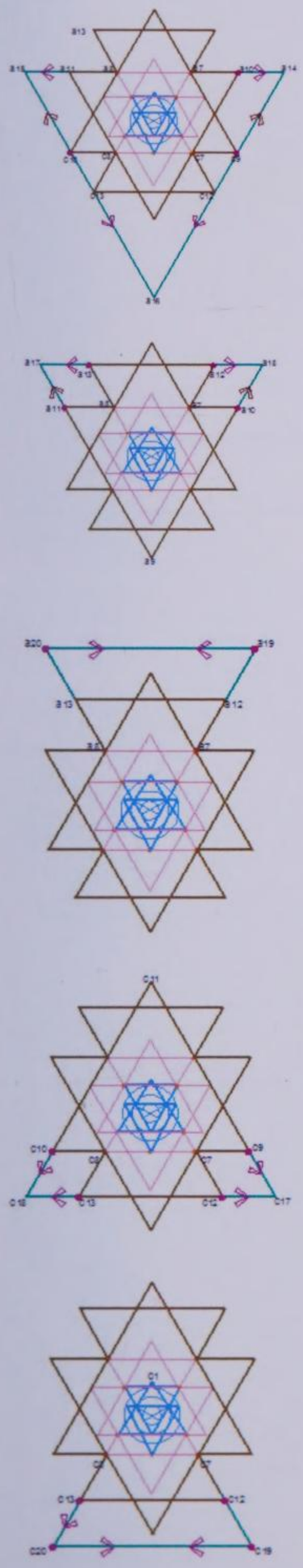
xi. The base 'c8-c7' of the bottom *vahni* triangle of the first ten-point is extended to points 'c10' and 'c9'. (Fig. C.2.b)

xii. Making its sides 'c10-c11' and 'c9-c11' forms the sides of the vahni triangle 'c9-c10-c11'. These sides touch the base points 'a7' and 'a8' of the first *shakti* triangle. (Fig. C.2.b)

xiii. As with the first ten-point the second ten-point figure also follows the similar pattern. The points 'a6' and 'a7' are extended upwards to points 'a10' and 'a11'. (Fig. C.4.a) The points are located such that the distance between'a10-a11' and the base of the second *shakti* triangle is equal to the distance between this base and the extreme bottom apex point of the first ten-point figure. (Fig. C.3.a)

xiv. The lower *vahni* triangle's base 'c8-c7' of the first ten-point is extended downwards to 'c13' and 'c12' till the line 'c13-c12' touches the point 'a6'. (Fig. C.4.a-b)

xv. This action completes the creation of both the ten point figures. The first is 'c6, a8, a4, c5, c8,



Top Left and its bottom
Figure D1.a, D1.b, D3.a, D3.b, D4.a, D4.b, D5.a, D5.b, D6.a, D6.b

a6, c7, c4, a5 and a7'. The second ten point created is 'c11, a13, a11, c10, c13, a9, c12, c9, a10 and a12' (Fig. C.5)

***Step* 4: Drawing the fourteen point**

i. After the two ten-point the next in the Sri Yantra sequence is the fourteen-point.

ii. First an inverted triangle 'a15-a16-a14' is constructed. (Fig. D.1.b)

iii. The points 'a11' is extended to 'a15' and the point 'a10' is extended to the point 'a14'. The points 'a15 and 'a14' are then joined with 'a16' to form a triangle with its sides 'a15-a16' touching points 'c10' and 'c13'. The other side 'a14-a16' touches points 'c9' and 'c12'. (Fig. D.1.a)

iv. The triangle 'a11-a9-a10' is projected upwards to points 'a17' and 'a18' such that the line 'a17-a18'passes through the *shakti* triangles points 'a13' and 'a12'. (Fig. D.3.a-b)

v. The triangle 'a20-a19' is projected upwards to points 'a20' and 'a19'. (Fig. D.4.a-b)

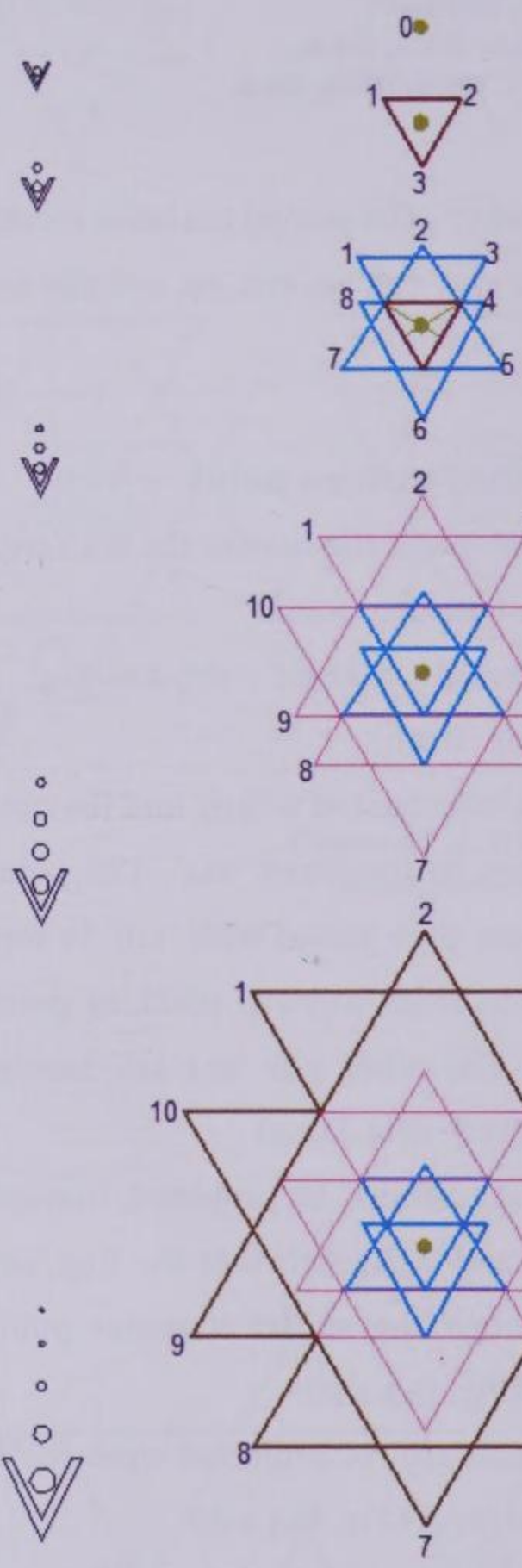
vi. The base points 'c10' and 'c9' of the triangle 'c9-c10-c11' are projected downwards to 'c18' and 'c17'. The *vahni* triangle thus formed will be passing through points 'c13' and 'c12'. (D.5.a-b)

vii. Similarly the extension of the points 'c13' and 'c12' downwards to points 'c20' and 'c19' will form another *vahni* triangle. (Fig. D.6.a-b)

viii. Also the triangle 'c15-c14-c16' is formed in a similar way.

ix. The complete process of its formation is summarised in Fig. F1

5.7 Stages of Development



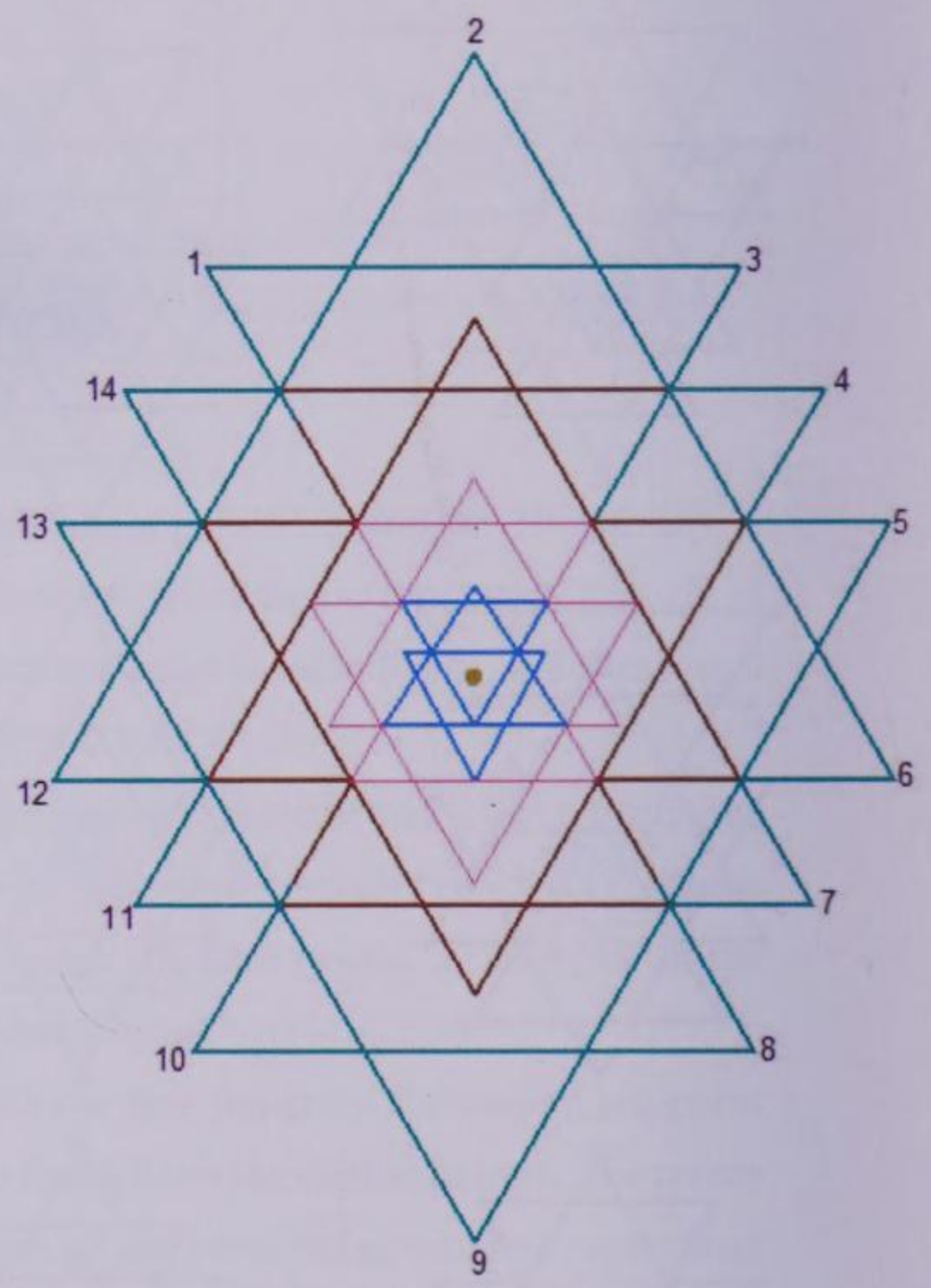


Figure. F.1

Garbhagriha Doorway, Osian, Jodhpur, Rajasthan

6-Mandala - An Incomplete Tool for Analysis of the Temple Plan

Case Study : Shiva Temple at Mundeshvari, Shahabad District, Bihar, Early seventh Century

Figure 6.1 Map of (Madhya Prahesh) and Mundeswari (Bihar), (All maps here on if not otherwise mentioned modified after George Michell, *Hindu Art and Architecture*, (London, Thames and Hudson, 2000), p. 212)

At the Siva temple at Mundesvari, Shahabad District, Bihar, *ca.* A.D. 636, Meister explores, however briefly, the possible use of circle, to explain the points which do not lie on the gird (Fig.6.2).

I wish to analyse this plan, which will try to solve the doubts & irregularities shown by Meister. He also speaks of replacement of the square grid for the outer walls in the twelve-sided Siva temple at Indor, Dist. Guna, Madhya Pradesh, 8th Century A.D.[1]

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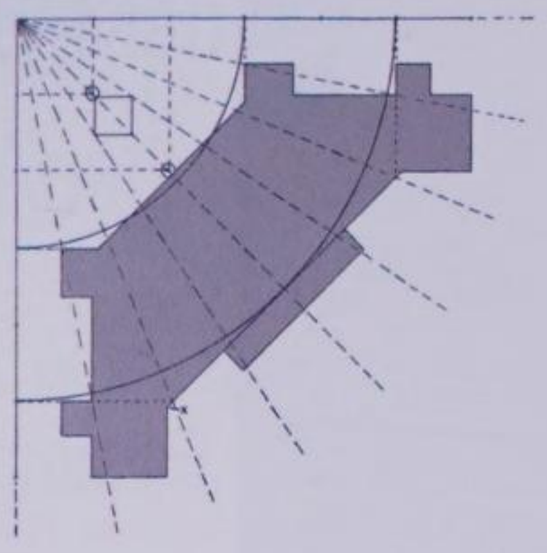
[1] Michael W. Meister, 'Mundesvari: Ambiguity and Certainty in the Analysis of a Temple Plan', in Kaladarsana, (American Studies in the Art of India) ed. by Joanna G. Williams, New Delhi, 1991), pp. 77-89, (p.88)

Chamunda Devi Temple, Mahua, Madhya Pradesh



Top

Figure 6.2 Segment of the plan of Siva Temple, Mundeswari, Bihar, at the *jangha* level, which shows point 'X', not coinciding with the grid. Fig. 5 & Fig. 6 after Michael W. Meister, 'Mundesvari: Ambiguity and Certainty in the Analysis of a Temple Plan', in *Kaladarsana*, (*American Studies in the Art of India*) ed. by Joanna G. Williams, (New Delhi, 1991), pp. 77-89, (p.84)

facing page from top to bottom

Figure 6.3 Shiva temple at Mundeshvari, Shahabad District, Bihar, early seventh century. Ambiguities in interpretation (as shown by Meister) and the possible use of mandala (grid) as the definitive means of temple design.

Figure 6.4 Shiva temple at Mundeshvari, Bihar, assuming that the central pedestal is square, (which reflects problems with Meister's drawing) besides the central diagonal, no other diagonal grid line will pass through it.

Meister's analytical drawing of Udayeshvara temple, Udayapur, Madhya Pradesh and also Volwahsen's analysis of Brahmeshvara temple at Bhubaneshwar (Bhuvaneshvara) show the SCS starting from the wall of the *garbhagriha*. Meister analysed the rotating square of the stellate plan, to show how, ' the architects of some temples began to give expression to this time function by using a rotating plan with angled buttresses in both cardinal and subcardinal positions. Such a "stellate" temple's highly faceted walls, much like those of a fortress, both reflected and protected the inner divinity.'[2]

I do not mean to undermine the importance of the *mandala* (the *vastupurushmandala* in its popular symbolic sense), since specially, it is a very useful tool for the roof plans both of the *Shekhari* and the *Samavarna* type which we will see later in detail but, it definitely falls short for being able to completely and satisfactorily explain the various details, proportions, placements and locations in the temple design. Its inadequacy will be demonstrated below, using the example of Shiva temple, Mundeshvari, Bihar.[3]

Meister describes, 'Mundeshvari's plan is octagonal. The sanctum is also octagonal, with four entries on the cardinal directions. Four pillars in the sanctum form a square in which the Shiva *linga* was centred.'[4] The *linga* is *caturmukha*[5]; although the dimensions are not available this analysis has been conducted by using Meister's drawings of the temple along with its *linga*. There are some discrepancies in his drafting that will be evident though computer drafted analytical drawings.

The application of just the *mandala* grid for analysis will result in the ambiguities as expressed by Meister. A more comprehensive geometrical application whether symbolic, constructional or morphological result in

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[2] Michael W. Meister, 1993, pp. 94-115 (p.96)

[3] There is a mixed view about the dating of the temple, Michael W. Meister, 1991, p.87. Krishna Deva, Temples of North India, New Delhi, 1969, p.14, who writes "the temple is securely dated in 636 by an inscription." Fredrick Ashler, has questioned the authenticity of the present structure in his unpublished dissertation, "The Sixth-through- Eight Century Sculpture of Bihar", University of Chicago, 1971, 73, where he proposes that the structure could have possibly been restructured in the fifteenth century from old parts. This opinion, Meister notes that Ashler had revised in, "The Mundeshvari Temple, in Journal of the Society of Architectural Historians, XXXI (1972), pp.232-33.

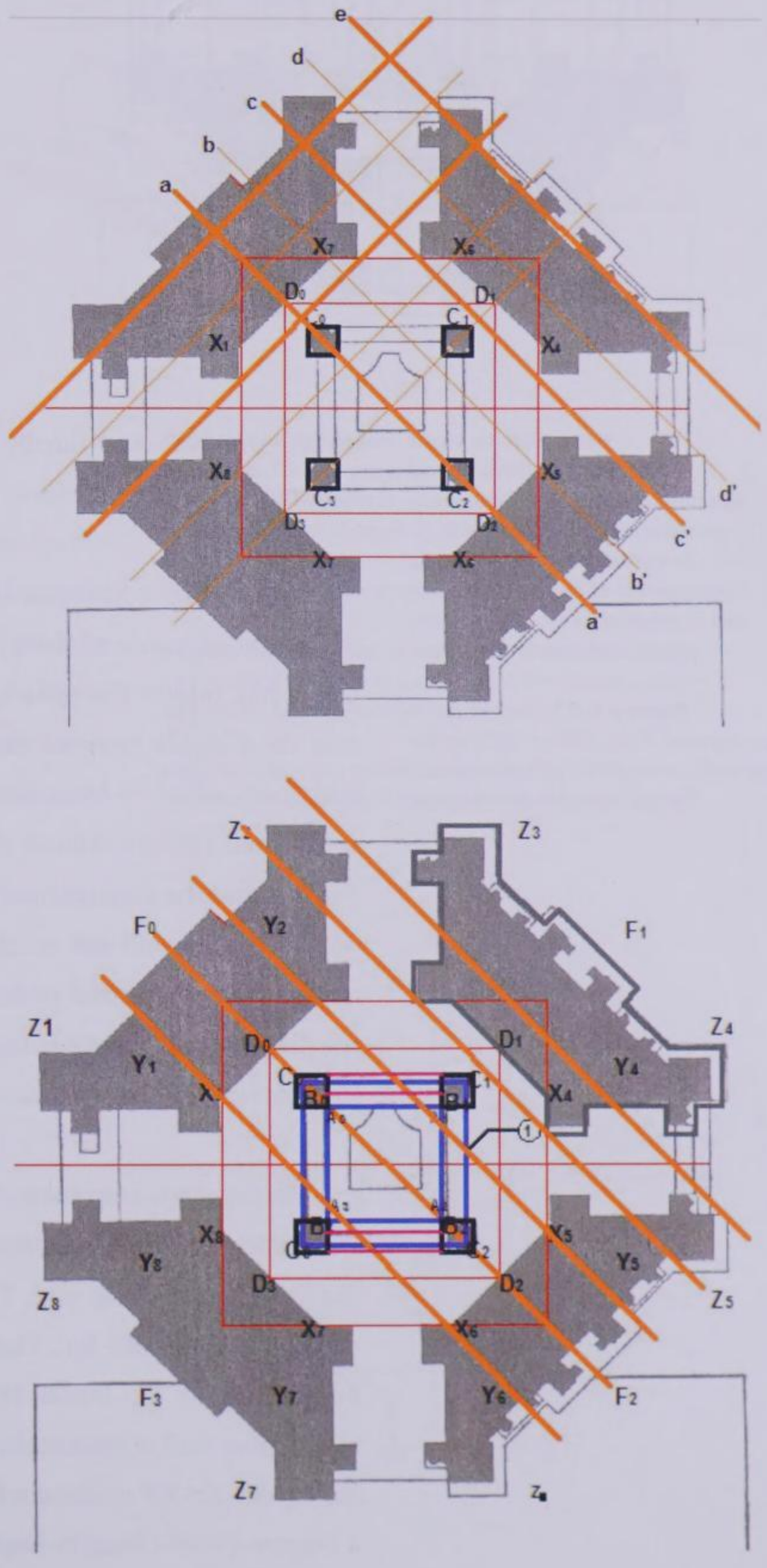
[4] Meister, 1991

[5] The four faced one.

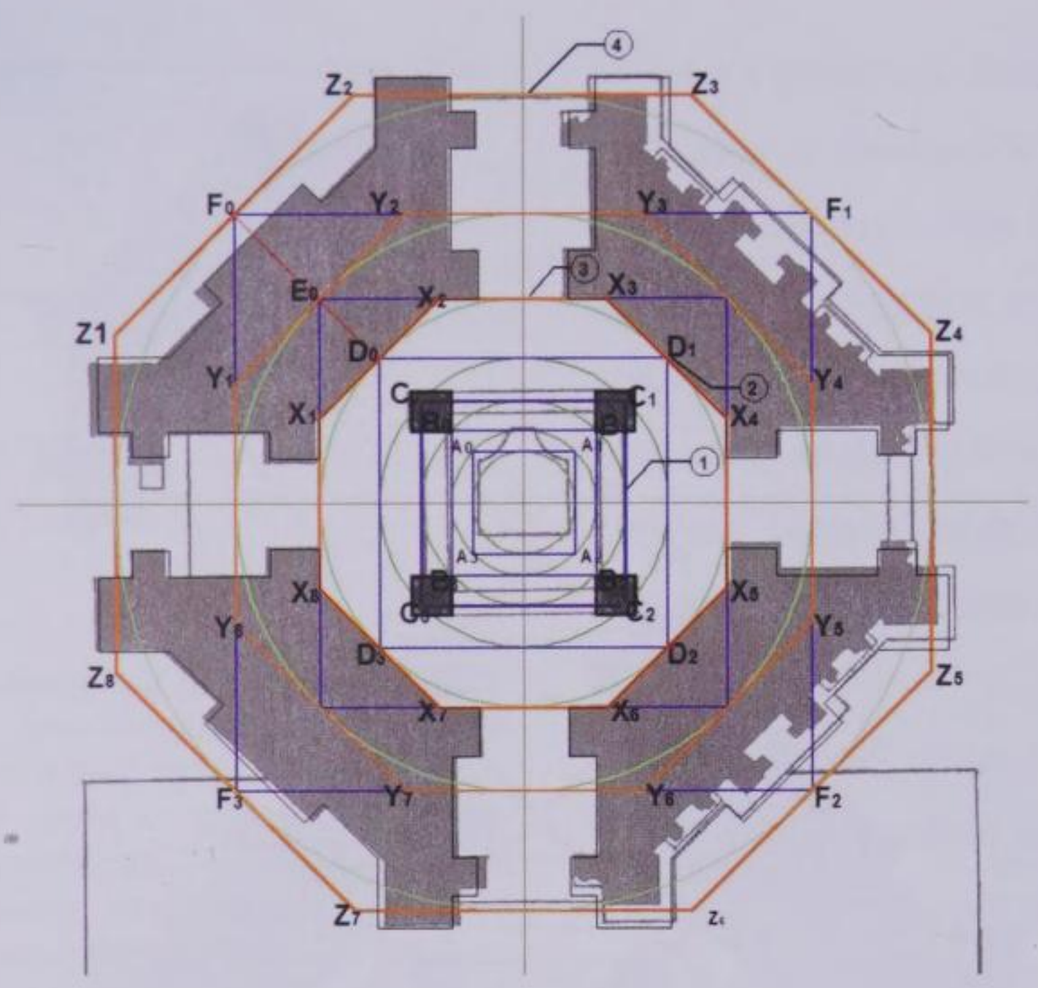
certainties as shown in the case of Brahmeshvara temple, Bhubhaneshvar. The fact that, Meister relies heavily on the *mandala* grid for the sole explanation of the plan and it's planning points, result in the ambiguities as he expressed for Mundeshwari, 'by the beginning of the seventh century the *Latina Nagara* tower, built above a sacred square (the *Vastupurushamandala*), had been formulated for the stone temples, complete in its condensation of symbolic as well as architectural forms.' Also he feels that, the insufficiently available data is the cause for these unexplained facts, which is not the case.

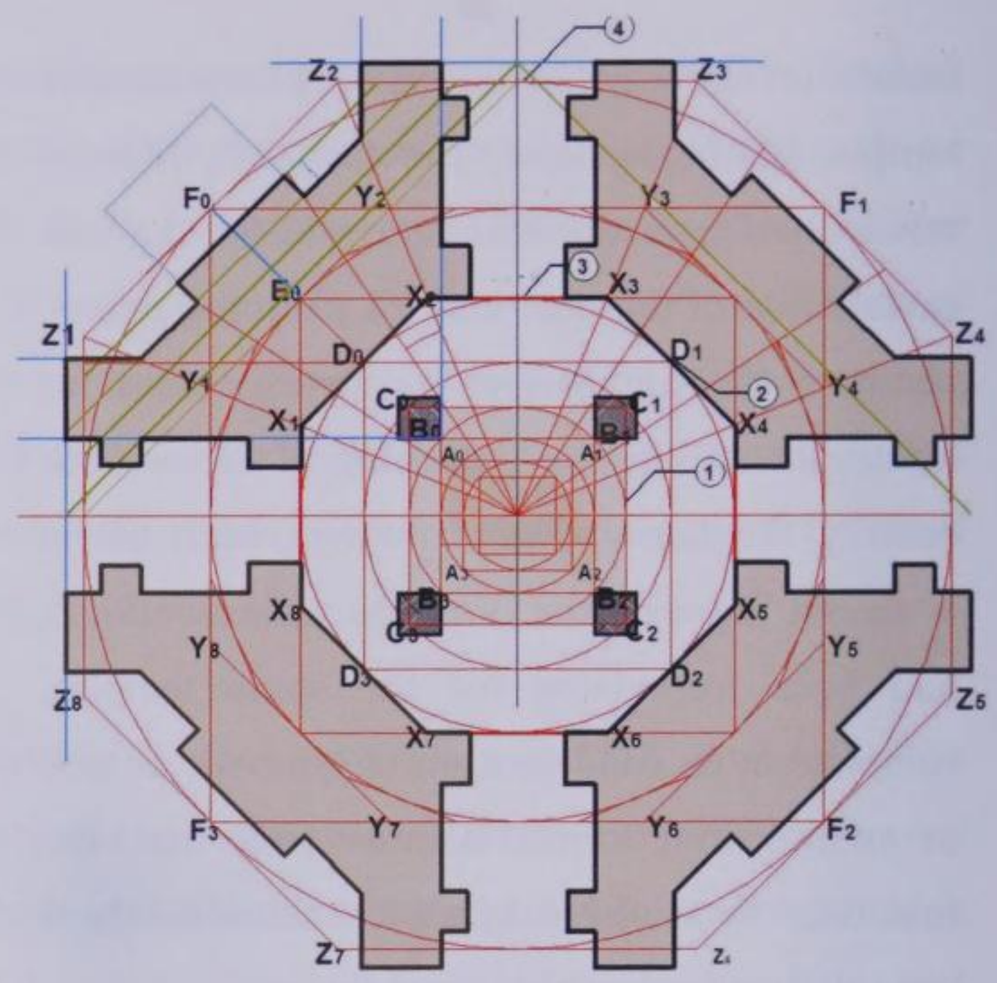
I would like to emphasis here, that a more experimental and flexible approach along with a more precise drawing and testing tool like the computer should be widely applied to find solutions to these ambiguities. On scanning the drawing by Meister and upon drafting on top of it with the help of computer, it is found that the drawing are not symmetrical and similar where it should have been. The Figs. 6.3-6.4 both demonstrate the incorrectness of the Meister's certainty that the *mandala* explains the complexity of the Mundeshvari plan.

If we refer to his drawing[6] we can note three important points. The first that the pedestal, on which the *linga* and its pedestal has been placed, is square that is not the case in Diagram A[7]. Secondly the grid passes through the corners of the diagonal edge of the octagonal internal wall



6 Meister, 199. p80. Diagram D, titled 'gird producing plan approximating that at Mundeshvari'.
7 Meister, p 78.





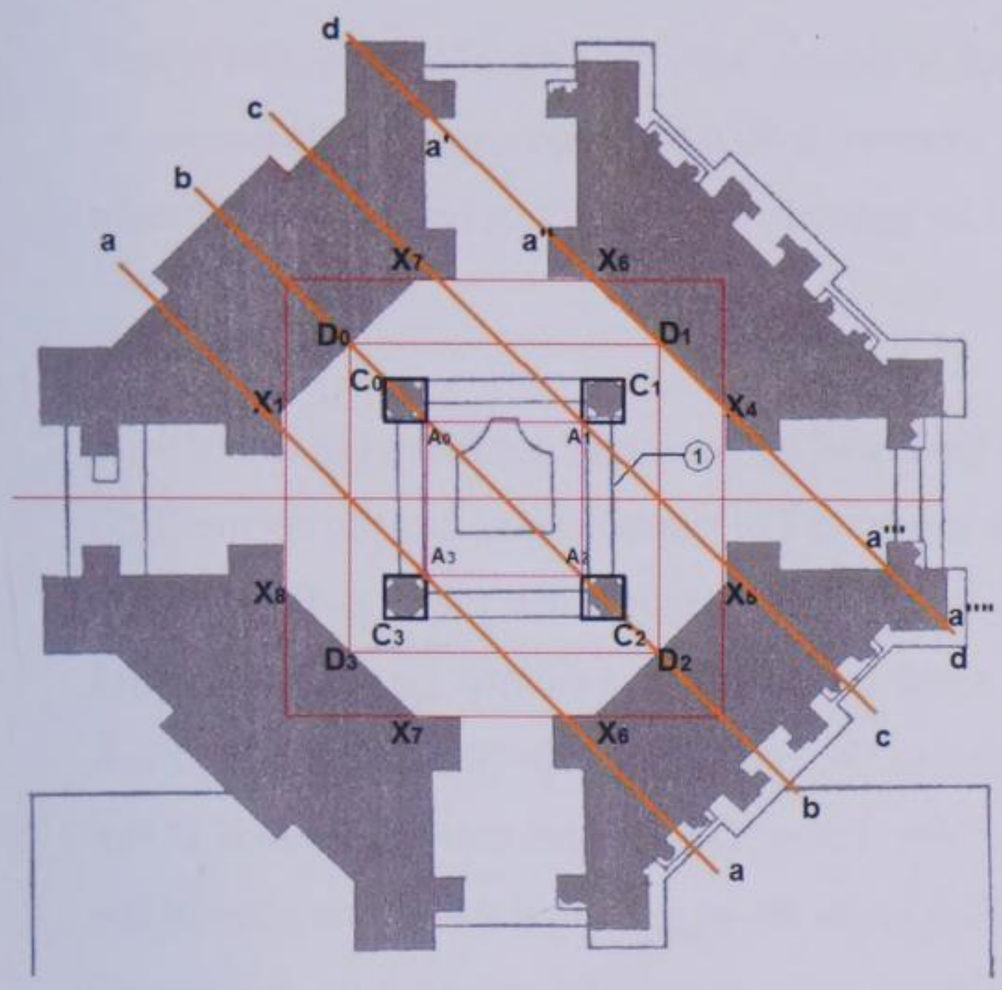
From left to right
Figure 6.5 Shiva temple at Mundeshvari, Bihar, SCS originate from the lingam circle. The SCS, before defining the octagonal characteristic of the inner sanctum wall, it establishes the orthogonally placed pedestal in the centre.

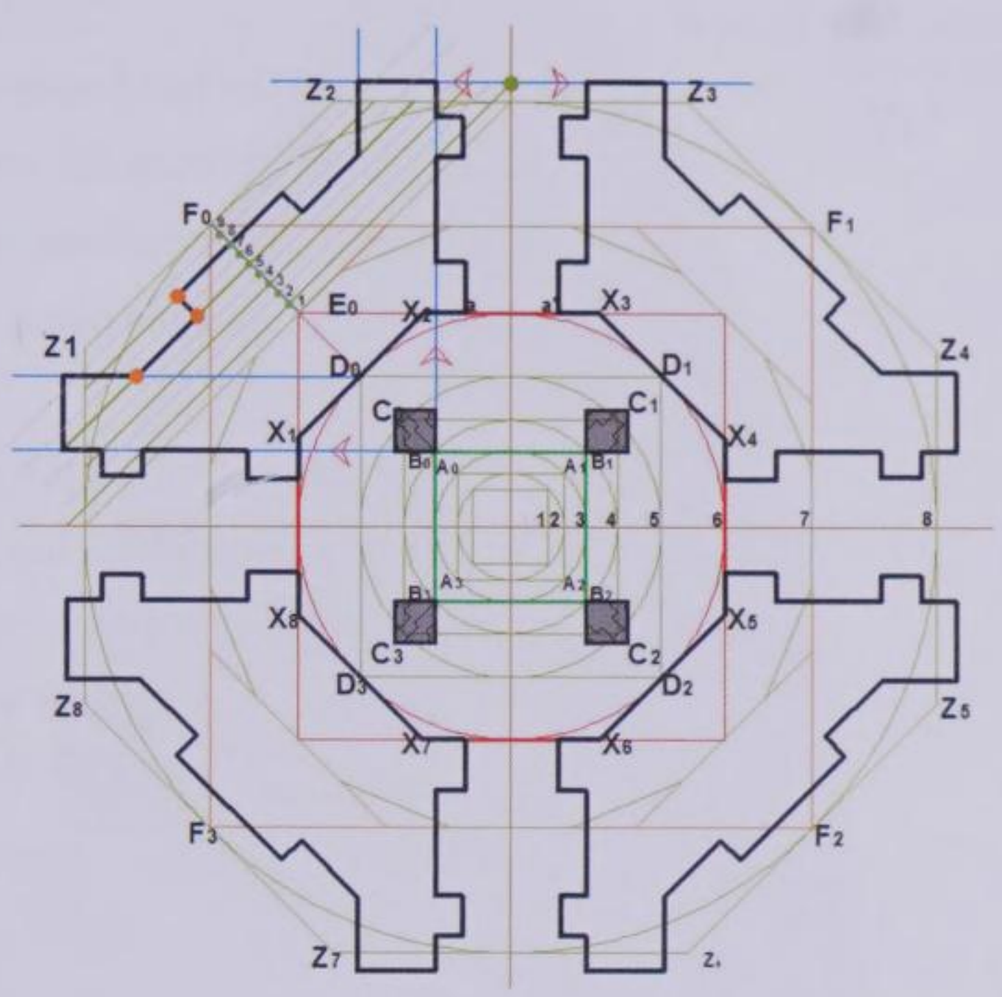
Figure 6.6 Shiva temple at Mundeshvari, Bihar,Use of SCS for the complete analysis and identification of the points on the temple plan.

at 'X1' and 'X2'. And thirdly the grid coincides with the outer most edge of the internal wall of the entrance.

In the Fig. 6.3, it can be seen that the diagonal grid 'a-a'' passes through the center of a side of the internal octagonal wall, 'X1-X7' and at the same time diagonally bisects the pillars, platform and the *lingam*. If we create a grid such that the distance between the grid is the vertical distance between the line 'a-a'' and 'b-b'', where 'b-b'' is the line which passes through the corner points of the orthogonal internal wall of the sanctum at 'X7' and 'X5'. It can be noted in the Fig. 6.3 that the diagonal 'c-c'' do not pass through any point of relevance neither on the temple wall nor on the sanctum idol and its pedestal. In the Fig.6.4 we assume that the central pedestal is square, 'A0-A1-A2-A3', and then too, besides the diagonal, which passes through F0 and F2, no other diagonal will pass through the central pedestal.

In these circumstances, let's consider alternate methods for design analysis. Firstly, let us consider the first square 'A0-A1-A2-A3' of the SCS to originate from the *lingam* circle (Fig. 6.5). This will form the sequence, which will have the next square as 'B0-B1-B2-B3'. The square 'C0-C1-C2-C3' also marked as '1' in the Fig. 6.5. The square 'D0-D1-D2-D3' will touch the middle points (e.g. at '2') of the sides of the inner wall of the sanctum, which forms a circumscribed octagon 'X1-X2-X3-X4-X5-X6-X7-X8' on the circle 'C3'. In this case, the SCS sequence gets modified to a Square-Circle-Octagon-Sequence. The 'Z1-Z2-Z3-Z4-Z5-Z6-Z7-Z8' octagon will





give, the external edge of the wall at '4' (Fig. 6.5).

Let us consider the *mandala* grid for this temple. In the fig. 2.51 we can see that, if we consider 'b-b' as a diagonal grid bisecting the columns 'C0' and 'C2', and also the podium 'A0-A1-A2-A3' into two, and then take the next *mandala* grid spaced at the perpendicular distance between the center of the SCS and 'A1'. In other words, the distance between the grids will be half the bisecting diagonal of the square 'A0-A1-A2-A3'. Now, the diagonal grid 'b-b', which has 'a-a' and 'c-c' as adjacent diagonal grids, will touch the first square at 'A1' and 'A3', respectively, but will not identify any points of the inner wall. The diagonal grid'd-d' is next to 'c-c'. Diagonal line 'd-d', will pass through the octagonal inner wall of the sanctum at 'X3' and 'X4', and also pass through points 'a'' and 'a''''' the corner of the entrance, and 'a''' is the edge of the projecting pilaster at the entrance and 'a''''' is the edge of the entrance on the external side (Fig. 6.7).

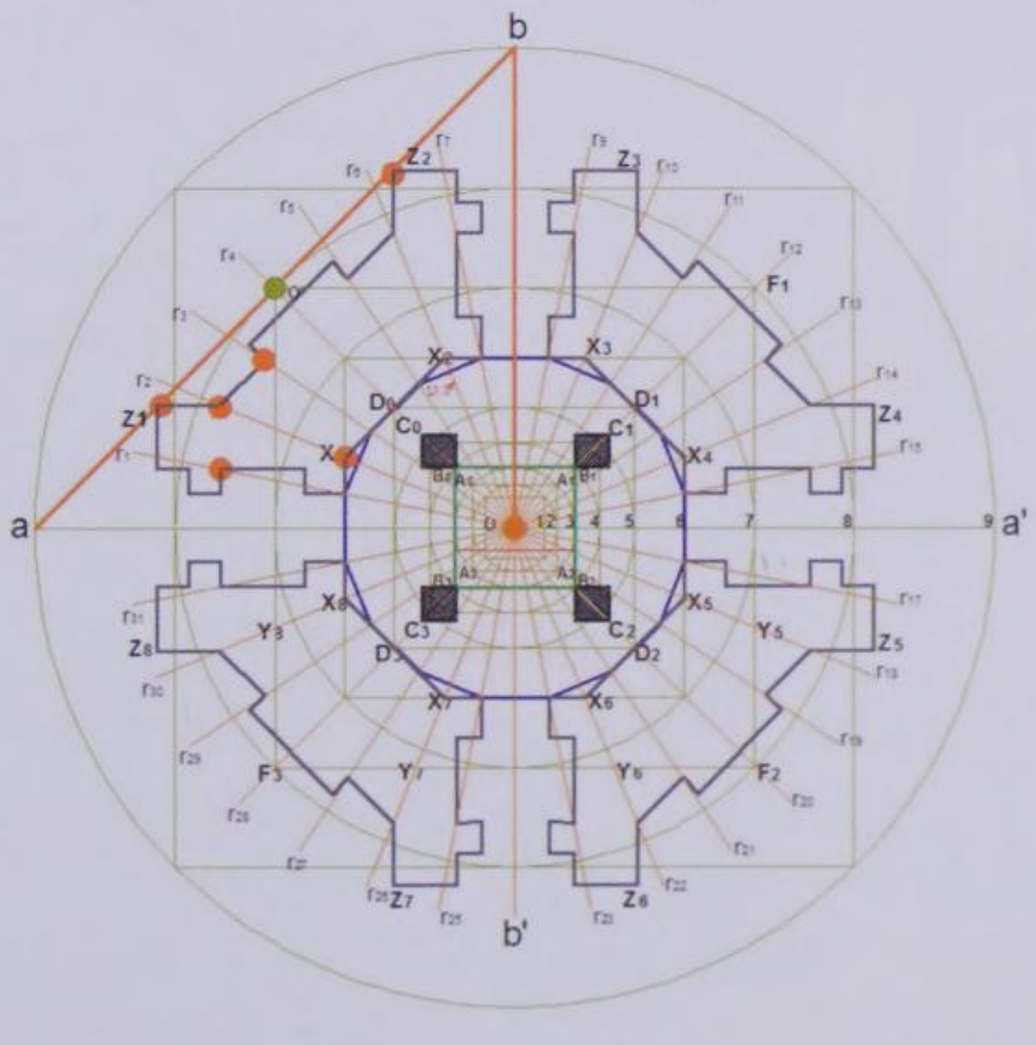
The geometry of the temple of any shape or form is usually derived by the varied application of geometrical principles, some general and some unique. In Fig. 6.7, we will have a look at these applications. The wall of the entrance passage is the

Clockwise from left

Figure 6.7 Shiva temple at Mundeshvari, Bihar. Using the SCS for creating a diagonal gird (distance between the grid is equal to half the diagonal width of the first square of the SCS), which helps in locating the inner wall of the sanctum.

Figure 6.8 Shiva temple at Mundeshvari, Bihar. Geometrical analysis of the external wall profile using equal sub-division method.

Figure 6.9 Shiva temple at Mundeshvari, Bihar. Geometrical analysis of the external wall profile using equal radials



projection of the third square, which is shown, with the help of arrows. The points on the external octagonal wall are received with a technique apparently unique to Mundeshawari or perhaps it could be general, for I have not tested this principle out on similar temple plans.

The preciseness of the points governed by geometry confirms the use of SCS. The sixth square, which lies on the inner wall of the sanctum, has the corner 'E0'. The next seventh square is 'F0- F1- F2- F3'. The diagonal distance 'E0-F0' between the corners when divided into 9 equal parts will give points 1,2,3,4,5,6,7,8 and 9 when projected at 45° or parallel to the octagonal side 'X1-X2' will establish relationship to the external wall offsets. Point '1' will meet the vertical axis at the point represented by a green dot. This point transcends to the extreme edge of the external wall at 'Z2' and 'Z3' where it will meet the rays from square '3' and square '5' as shown above. The parallel rays from the fifth and the seventh point of 'E0-F0' will lie on the offsets of the external octagon as shown by orange dots in the Fig. 6.7. The question, which can be raised, is that the orange dots can lie any where on the fifth and the seventh ray. This will be sorted by finding another ray, which will intersect these at the given points.

This can be achieved by two methods one analytical and other constructive. In the Fig. 6.8, the 90° angle formed between 'a-o' and 'b-o' when divided into 8 parts having the angle between each equal to 11.25° will also give the same orange dots which lie on the external wall of the octagon. Joining point 'a' and point 'b' which lie on the quadrant of the ninth circle can receive the points 'Z1' and 'Z2' (Fig. 6.9).

In the Fig. 6.10 we can see that an eight-pointed star can also give useful results. Points 'a', 'a'' are points on the external wall. Points 'c' and 'b', 'c'' and 'b'' lie on the pointed star also confirm with the inner wall of the entrance passage. Point 'f' does not lie on the pointed star but can be achieved by drawing a perpendicular from point 'e' and meeting the line drawn from the seventh part of 'E0-F0' as shown in Fig. 6.10.

Also an important observation that can be made is that the measurement of the distances 'x' and 'y' of the entrance confirms to the sides of the second and the third square. This analysis of the Siva temple, Mundeshvari, Bihar I hope will solve the ambiguities as expressed my Meister and also address the *mandala* not just the only tool for analysis and also enable us to carefully choose the grid or

Bhumija Temple,Nemawar,
Madhya Pradesh

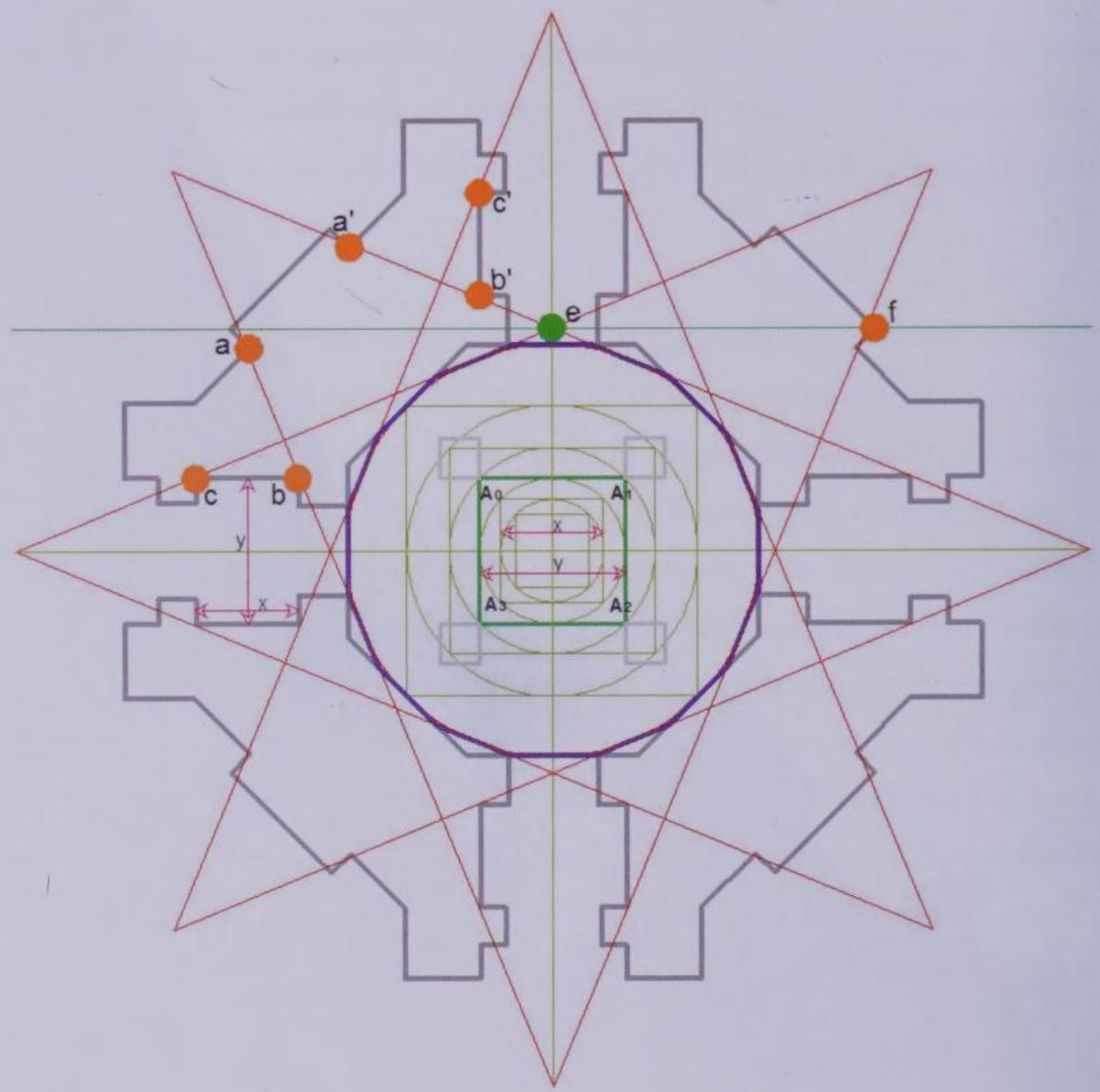


Figure 6.10 Shiva temple at Mundeshvari, Bihar. Geometrical analysis of the external wall profile using star formation

Facing page Jangha detail, Prasada, Nemawar, Madhya Pradesh

the *mandala* unit. Another complex application of geometric principles can be seen at Brihadeswara temple Complex, Tanjavur, Tamil Nadu. The Volwahsen's analysis of the Brihadeshvara temple at Tanjavur (Tanjore) shows the SCS start at the edge of the outer wall of the *prasada*. The Siva temple, Mundeswari, Bihar has been primarily worked on the *mandala* grid, which Meister suggests is the basis of its plan. He indicates intersection of the orthogonal and the diagonal grid as *Marmas*[8]. The only possible use of circle for the Mundeshwari has been to explain these *Marmas*. The analysis can be redone with the addition of the rotated square principle, to be introduced further in the study.

8 *Marmas* are points of intersection. Also see mention of the *marmas* for the Volwahsen's study of the ground plan of the ancillary shrine of Brahmeshvara temple, Bhuvaneshvara, Orissa. Also see Fig.8 for the red nodes indicating the marmas.

7-Applications of SCS Method

Having considered the various symbolic interpretations of the Square and the Circle let us now test the validity of the SCS principles by directly applying it to the temple plans and elevations. The use of circle to circumscribe a square can be for constructive geometry purposes too, which usually starts by the use of the chord and the gnomon for the construction of the square. Michael Meister has very well studied the use of geometry for construction for the Indian temples. The ground plan of Bhumija Udayeshvara temple, Udayapur, Madhya Pradesh, ca 1080 A.D. has been analysed for its stellate plan by using constructive geometry (Fig. 7.1 - 7.3)[1].

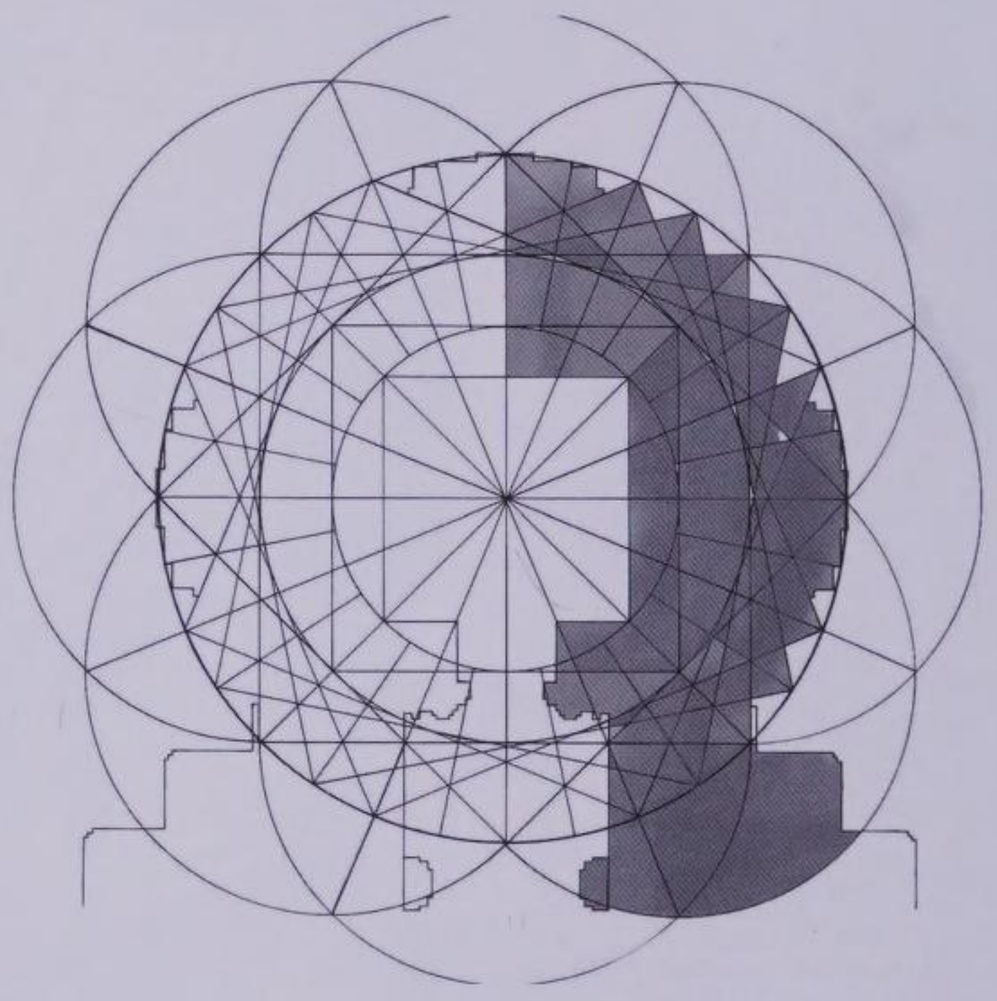


Figure 7.1 Udayeshvara temple, Udayapur, Madhya Pradesh, ca 1080 A.D. (courtesy Meister)

Three case studies will be carried out in the subsequent chapters. The first study on Brahmeshvara temple at Bhubaneshwar (Bhuvaneshvara), ca. A.D. 1060 is complete with descriptions where as, the other two case studies are pictorial analysis of two stellate temples Chennakeshva temple, Nagalpura, Tumkur District, Karnataka, ca. A.D. 1200 and Jagadamba Devi, Kokamtham. Maharashtra, *ca.* A.D. fourteenth century.

Facing page Shiva Temple, Group 4, Kadwaha, Madhya Pradesh

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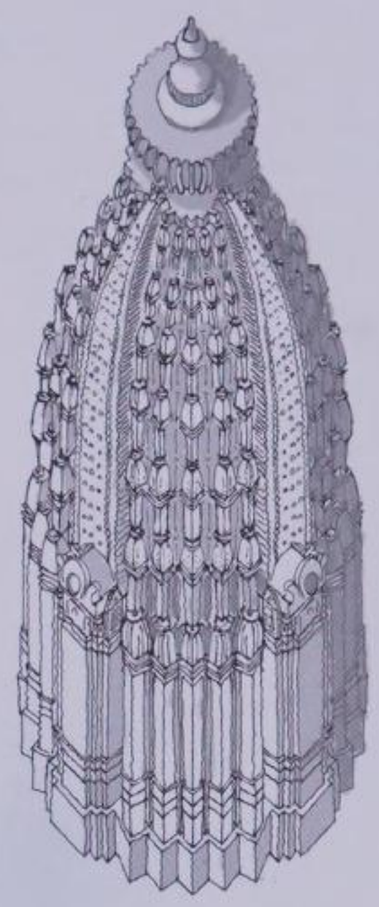
[1] Michael W. Meister, 'Fragments from Divine Cosmology: Unfolding Forms on India's Temple Walls', in Gods, Guardians, and Lovers: Temple Sculptures from North India A.D. 700-1200, eds. by Vishakha N. Desai and Darielle Mason, (Ahmedabad, Mapin Publishing Pvt. Ltd. in asstn. with The Asia Society Galleries, New York,1993) pp 94-115 (p.100)



Anti-clockwisefromrighttop
Figure 7.2 Udayeshvara temple, Udayapur, axonometric view (courtesy Hardy)

Figure 7.3 Bhumija temple, Nemawar, Madhya Pradesh

Figure 7.4 Map of Bhubaneshwar, Orissa

7.1 Brahmeshvara temple at Bhubaneshwar (Bhuvaneshvara), ca. A.D. 1060

Volwahsen suggests that, the walled platform, which supports the temple with its four ancillary shrines, was divided in a certain proportion. All the architectural members are incorporated systematically into a fixed network of lines. The platform is divided into 14 x 21 squares, each with sides measuring approximately 1.51 meters. The point of intersection of two diagonal lines, leading from the southwestern and northwestern corners of the platform, determines the ritual center of the building, the point above which, *Shivas's* symbol, the phallus or '*lingam*', is erected. The cella around the lingam affords just enough room for ritual circumambulation; the walls are devoid of any decoration. The *mandala*, containing 4 x 4 *padas*, is laid out around this center. By dividing these squares one obtains the *manduka mandala*, comprising 8 x 8 *padas*. Its corners are at the same time the corners of the external outline of the cella. To the east of the *garbha-griha* is the *mukhashala*, which follows its own rules of proportion.[2]

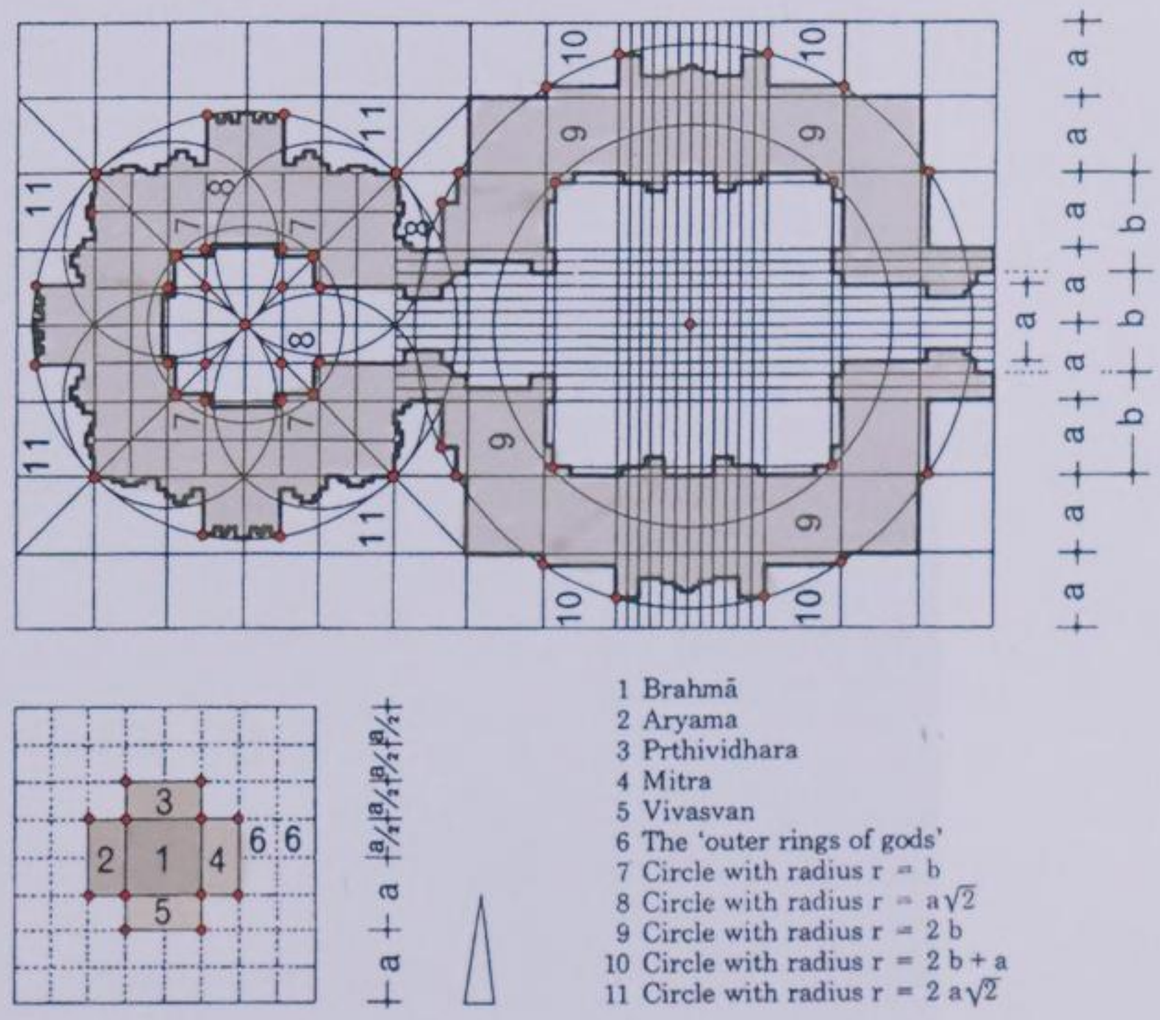
It is important to note two observations made by him, which show us the limitations in Volwahsens approach for analysis using geometry. Primarily, since

[2] Andreas Volwahesen, see ch. 'City and Temple Layout: The vision of a Cosmic Plan', in *Living Architecture: Indian*, (New York, Grosset & Dunlap, 1969), pp.51-2

From top to bottom
Figure 7.5 Brahmeshvara temple, Bhubaneshwar, Orissa, ca. A.D. 1060 (courtesy Hardy)

it is obviously based on *mandala* with an effort to look at the proportions at some instances, lets look at some such cases, with reference to Fig. 7.6, 'For some reason still unknown the structure of the *mukhashala* is based both upon a division of the interior into four parts, covering 16 squares in the plan, and upon a division into three parts. Three parts 'b' correspond to four parts 'a'. The smallest unit of measurement, which appears time and again in the ground-plan, is thus one sixth of 'a' or one-eighth of 'b'; consequently, 1'b' = 1 1/3 'a".[3] Another instance, where he is unable to relate the *garbha-griha* to the *mukhashala*, is 'There is, however, no optical link between the two chambers. Both the cella and the assembly hall have, in addition to their common east west axis, a symmetrical axis from north to south'.[4]

Figure 7.6 Brahmeshvara temple, Bhubaneshwar (courtesy Volwahsen, 1969, p.51)


1 Brahmā
2 Aryama
3 Prthividhara
4 Mitra
5 Vivasvan
6 The 'outer rings of gods'
7 Circle with radius r = b
8 Circle with radius r = a√2
9 Circle with radius r = 2 b
10 Circle with radius r = 2 b + a
11 Circle with radius r = 2 a√2

Although an attempt has been made to look into the intersection points generated from the square and

[3] ibid, p.52
[4] ibid, p 52

Brahameshvara temple, Bhubaneswar, Orissa, Courtesy Gerard Foekema

Siva temple, west elevation, Group 5, Kadwaha, Madhya Pradesh

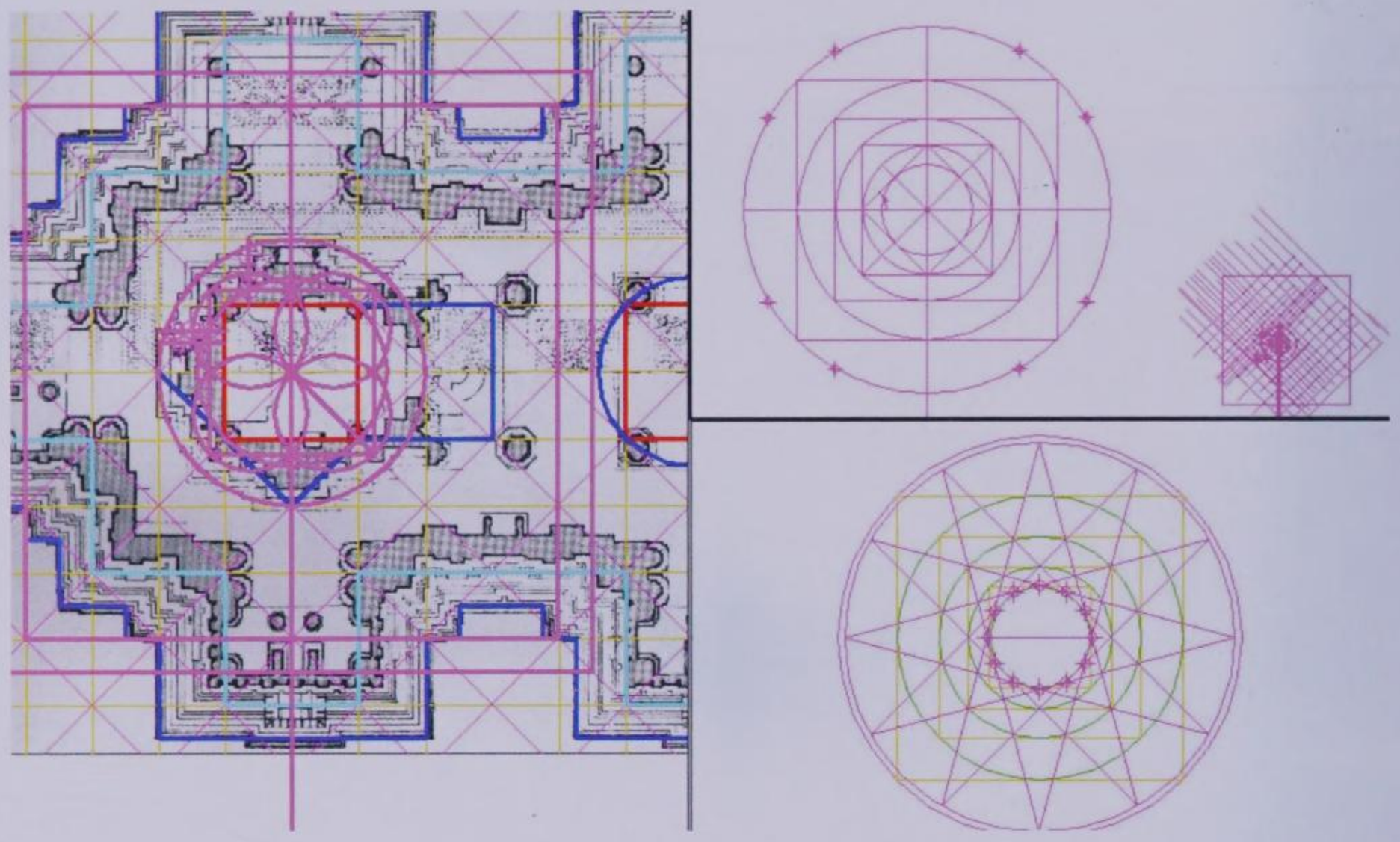


Figure 7.7 The top right diagram shows the process of application of the expanded square and the bottom right shows the superimposition of a twelve-pointed star on this diagram. The left half of the diagram shows the process of application of geometry on the garbha-griha of the Lakshmana Temple, Khajuraho. Note the application of the diagonal grid and also the outline of the main spaces, which fall on the grid. Image of Lakshmana temple is courtesy, Krishna Deva, Temples of Khajuraho: ASI, Architectural Survey of the temples, No 5 Plates (New Delhi, Archeological Survey of India, 1990).

the chronological division of the circle for the ancillary shrine, the mistake which is the problem with most of the studies is that there are done in isolation, i.e. if a principle is worked out in part of the temple it is not tested out in the remaining part of the temple, which leaves unanswered questions like the missing optical link.

7.1.1 Application of the Square-Circle Sequence for Design and Planning

This analysis of the Brahmeshvara temple at Bhubaneshvar has been started by using Volwahsen's plans.[5] This Orissan *rekha-deul*[6] temple is a *nirandhara-prasada*[7] with a single *latina* type *karna-manjiri*[8] *sikhara*. The Fig.7.8 is based on the Volwahsen's application of the squares where as the location of first square, in this figure is the same as that shown by him. The circle C4 of the SCS should go beyond what has been shown in the Fig.7.8, which stops at the outer wall of the *prasada*. Another observation that can be made from the Volwahsen's drawing

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[5] Volwahsen, p.51 and p.151

[6] Rekha-deul is an Orissan term, which means a curvilinear North Indian sikhara. The term 'sikhara' literally means head.

[7] Nirandhara-prasada is a temple without a covered or inner ambulatory (andhakarika). The temple with an inner ambulatory is called Sandhara-prasada.

[8] Karna-manjari or karna-sringa is a miniature replica of the main sikhara occurring on the corner (karna) projections.

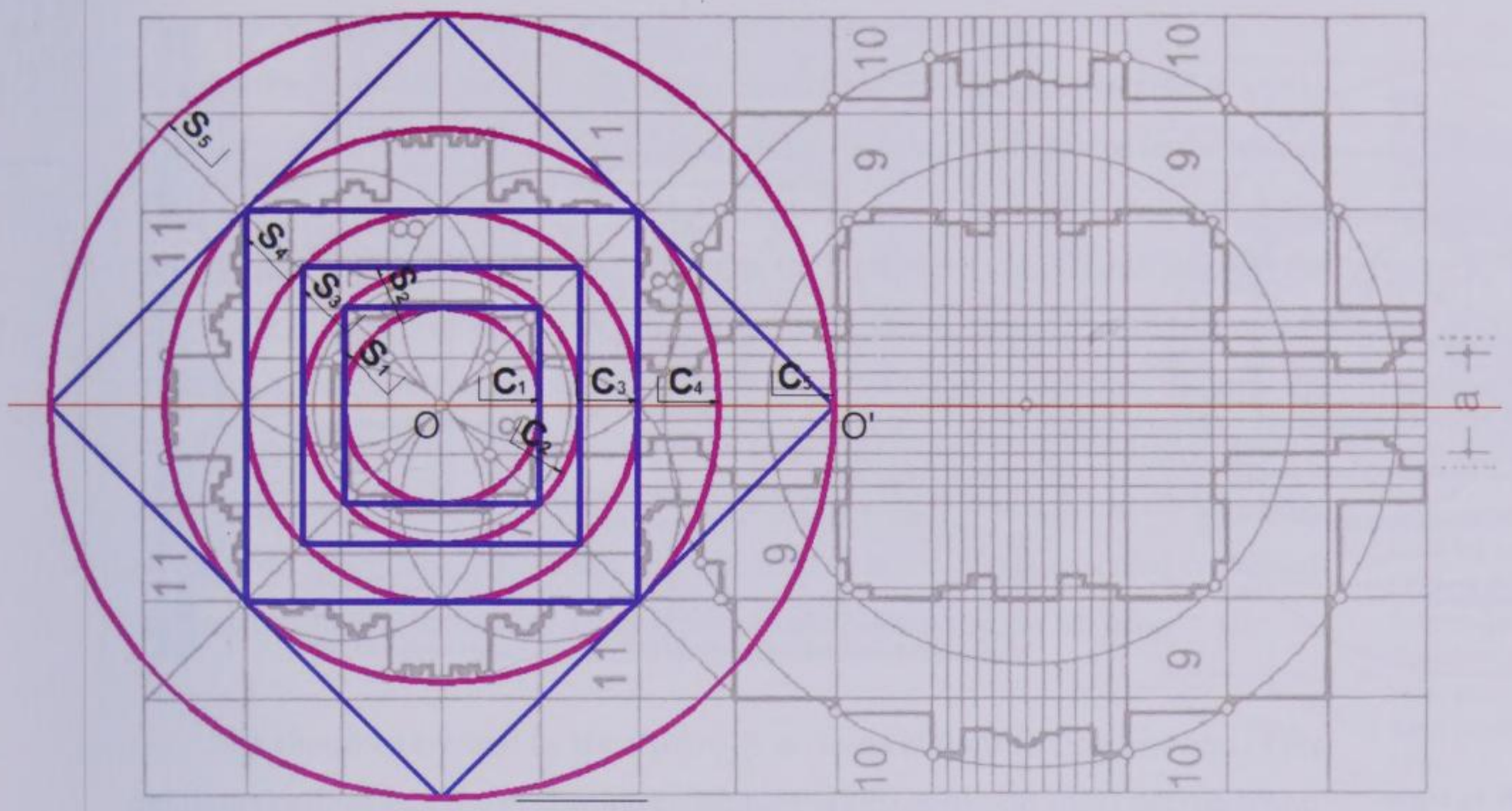
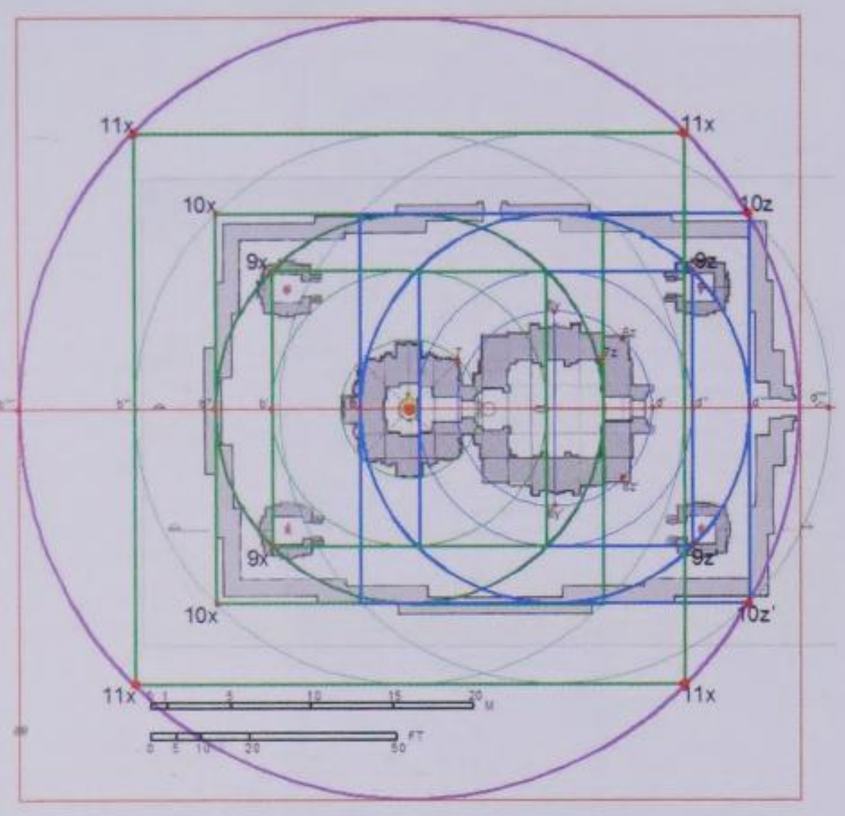


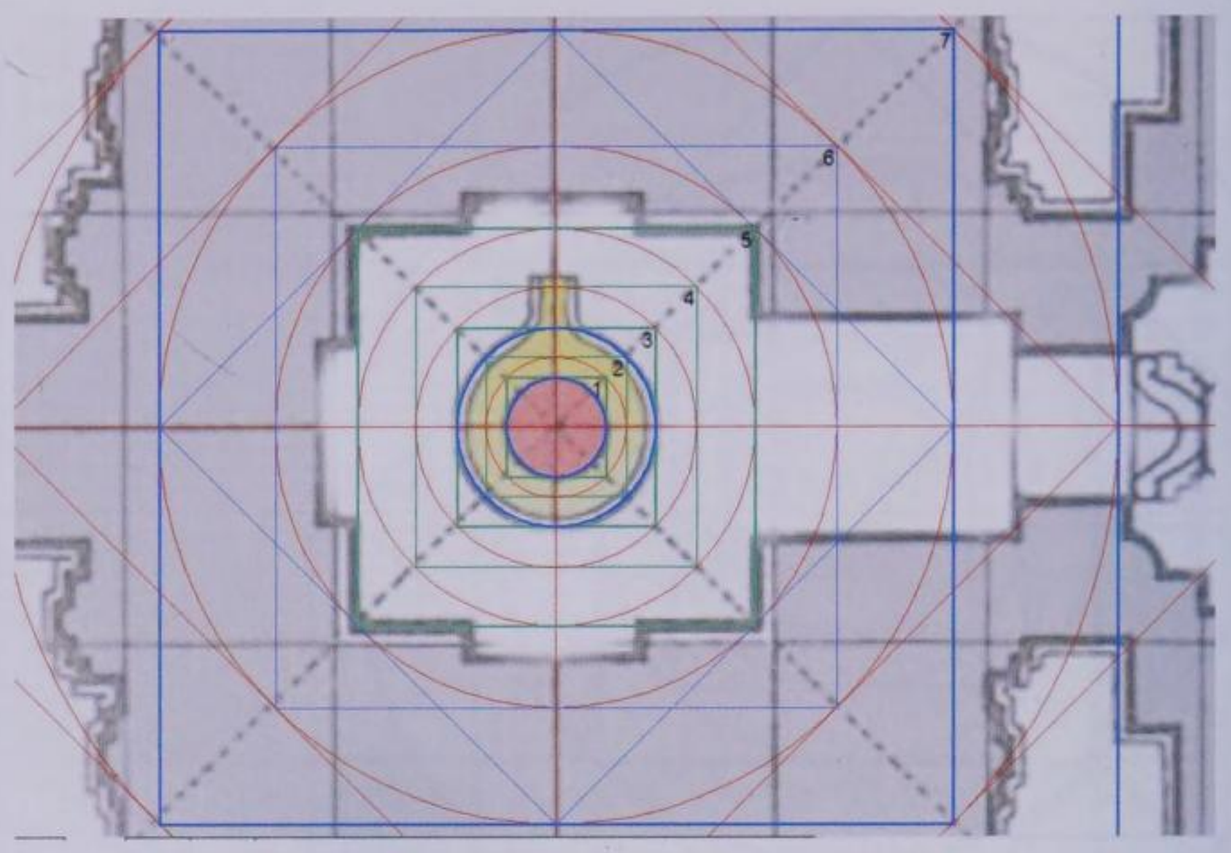
Figure 7.8 Brahmeshvara temple, Bhubaneshwar, Orissa. Application of SCS on Volwahsen's drawing

is that the squares drawn on the *prasada* are not related to that drawn on the *mahamandapa* and hence 'no optical link between the two chambers' can be formed.

Possibly, the calculation of the '*Vyayas*' has made him to consider the process of the planning of the temple as determined by the outermost edge of the *prasada*. Definitely, the grid is an important tool for the intricate proportioning system of the temple as can be seen from the Appendix (Proportions according to the ancient texts), but whether it was the only governing principal for the design of the temple is doubtable and definitely not for the establishing relationship between the *prasada* and the *mahamandapa*. The first circle can be drawn by two alternative methods. The first is, fixed by the overall dimensions of the temple, as could have been done by Volwahsen. The second method which has been followed here, is by fixing of the center of the *garbhagriha* point on the main length of the temple and then defining all the critical points of the temple by using the principle of SCS, diagonals and the use of the projections of the *marmas* derived from 8 point star.

The fact that the center of the *garbhagriha*, in the case of temples which have a *maha-mandapa* attached to it, does not lie on the middle of either the total length of the temple complex or the temple itself, means that there is a certain unequal proportion to which this ratio is worked out, i.e. the distance of the center of the





From left to right

Figure 7.9 Brahmeshvara temple, Bhubaneshwar, Orissa. Dual Application of SCS, starting from the *garbhagriha* as well as, from the *Mandapa*. The eleventh SCS circle originating from the core of the *garbhagriha* touches the tenth square of the SCS originating from the *Mandapa*, defining the relationship and distance between the two core centres

Figure 7.10 Brahmeshvara temple, Bhubaneshwar, Orissa. The origin of the SCS is the circle of the lingam. The SCS defines the proportion between the lingam, yoni-*pitha*, *garbhagriha* inner wall. It also relates to the *antarala* wall edge

garbhagriha from one edge of the temple complex is not equal to the remaining distance between the center of the *garbhagriha* to the other edge of the temple complex.

There is a possibility, that the circle which is generated far enough to include the whole temple complex originating from the *garbhagriha* point also has the square originating from the *mahamandapa* touching it at 10x-10x' (Fig.7.9).

7.1.2 Origin of the Square-Circle-Sequence in Brahmeshvara temple

The origin of the temple's geometric pattern is the circle of the lingam/image whose center in turn is the origin of the center of the *garbhagriha*. In the Fig. 7.9, we can see that circle of the lingam gives us the circumscribing square '1' which in turn in the sequence will give the other important squares of the temple. The third circle is the circle of the pedestal of the lingam and the fifth circle will give us the fifth square of the *garbha-griha*.

7.1.3 Correct location of the garbha-griha square

This will also give a reasonable solution to the question of the correct location of the governing geometric square at the *garbha-griha*. This means that this square will lie at the inner or the outer edge of the *garbha-griha*. It can be seen that the square lies at the inner edge of the *garbha-griha* and not the outer and also it is to be noted that in Volwahsen's plan which is primarily governed by the grid rather than the geometry the square is lying some what in the middle which would have been difficult to establish relationships with the other parts of the temple.

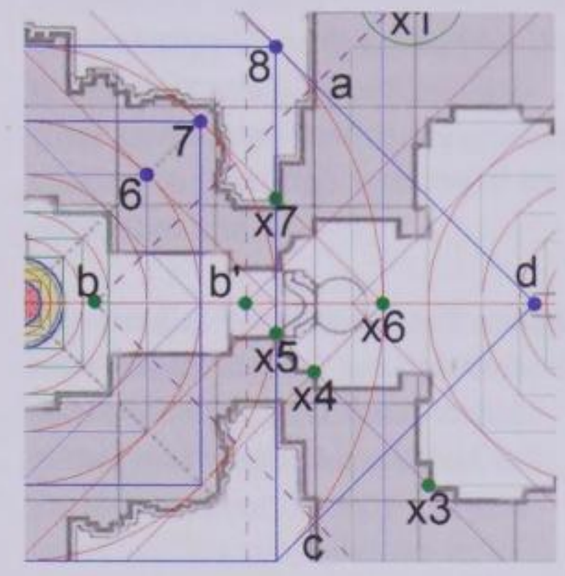
7.1.4 The Square and the Rhombus

Besides the circle and the square, the rhombus (a square which is rotated at 45° to the horizontal / vertical axis) too helps establish certain relationships in the overall geometrical scheme of things. In the Fig.7.10 it has been demonstrated that the corner of the rhombus created by revolving the circumscribing square '7' gives the line of the central projection (*bhadra*) of the eastern external wall of the *Mandapa* and also the rhombus created by the rotation of the square '8' passes through the external corner of the connecting passage between the *prasada* and the *Mandapa* (*antarala*), defines the projecting edge inside the *antarala* at 'x7' and also the edge of the rhombus circumscribes the circular step next to the semicircular or the half moon shaped step before the sanctum door (*chandra-shila*) at 'x6' (Fig. 7.11).

The rhombus created by the square '9' gives us at point 10 the location of the rectangular image in the center of the *Mandapa* (Fig.7.12).

7.1.5 Similar geometrical principle for Mandapa

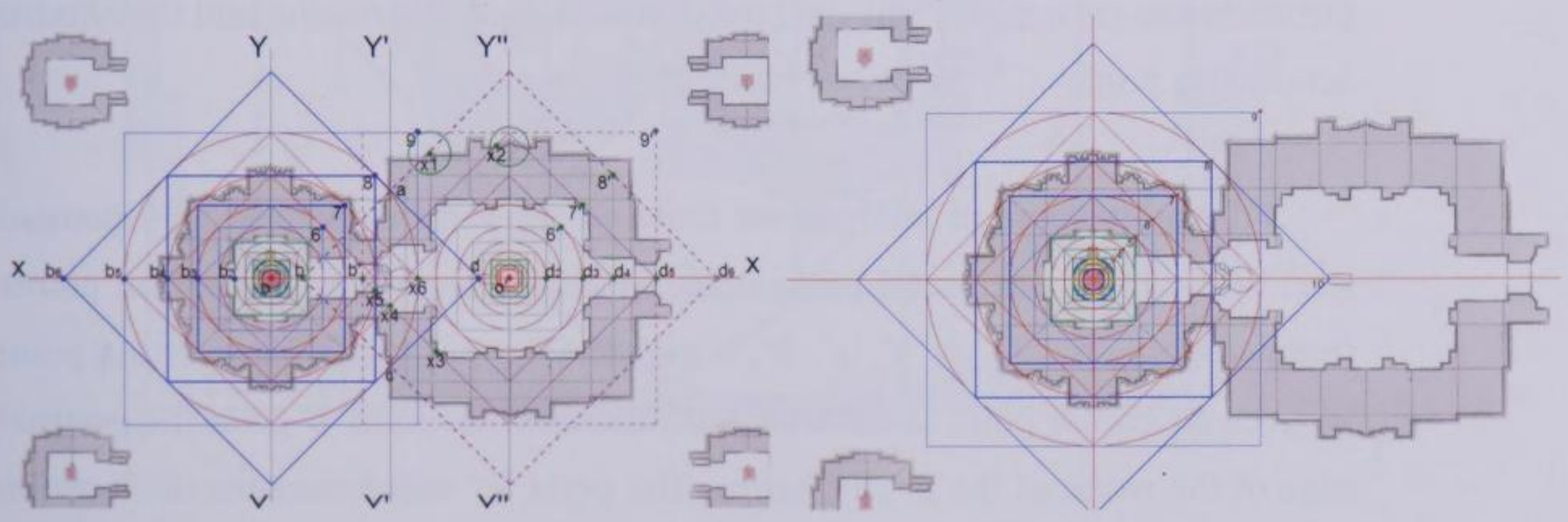
It is to be noted that the exact similar geometrical sequence of the SCS when applied to the *mandapa* will give us fruitful results. In the Fig.7.13, YY is the central transverse axis for the sanctum, Y"Y" is the central transverse axis for the *mandapa*, Y'Y' is the 'Axis of Union'[9] and XX is the longitudinal axis of the complete temple. Here it can be observed that the SCS of the sanctum that originates with the lingam when applied to the plan of the *mandapa* without any changes will give us the square '7' which will touch the internal corner of the *mandapa* at 'x3'. The corner angle of the rhombus created by rotating square '8' will contain the projected detail of the *bhadra* of the *mandapa* at 'x2'. Also the rotated square '9" will define the edges of the *pratiratha* of the *mandapa* at 'x1'.



Clockwise from top
Figure 7.11 Brahmeshvara temple, Bhubaneshwar, Orissa. Identification of the antarala, inner and outer wall profile, and the lines governing chandrashila form.

Figure 7.12. Brahmeshvara temple, Bhubaneshwar, Orissa. Location of edge of the nandi image in the Mandapa can be defined.

Figure 7.13 Brahmeshvara temple, Bhubaneshwar, Orissa. The exactly similar geometrical sequence of the SCS applied to the mandapa yields locations on the inner wall edge of the mandapa, location of the pratiratha, edge of the entrance doorway. The 'Axix of Union' which is the intersecting line between the two SCS systems defines the edge of the Mandapa.



[9] This axis is obtained by drawing the connecting line between the two intersection points, 'a' and 'c' of the two circles of the SCS of the prasada and the mandapa. Interestingly it also gives us the governing square of the mandapa and subsequently the corner points (karna) of the mandapa.

From top to bottom

Figure 7.14 Brahmeshvara temple, Bhubaneshwar, Orissa. Intersection points (*Marmas*) possibly define the intricate modulations in profile of *bhadra, pratibhadra and karna* (only for sanctum) edges of the sanctum and *mandapa*.

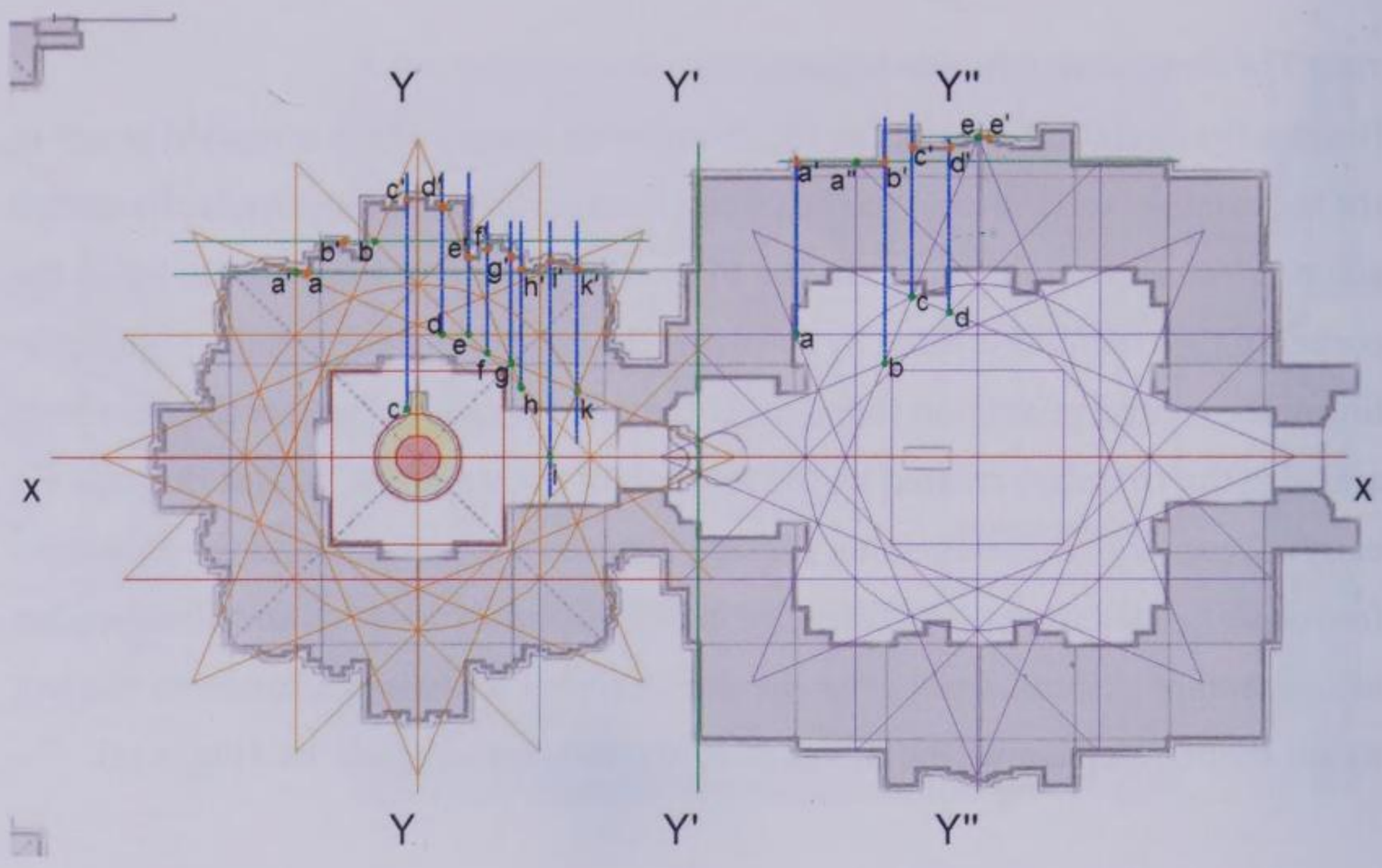
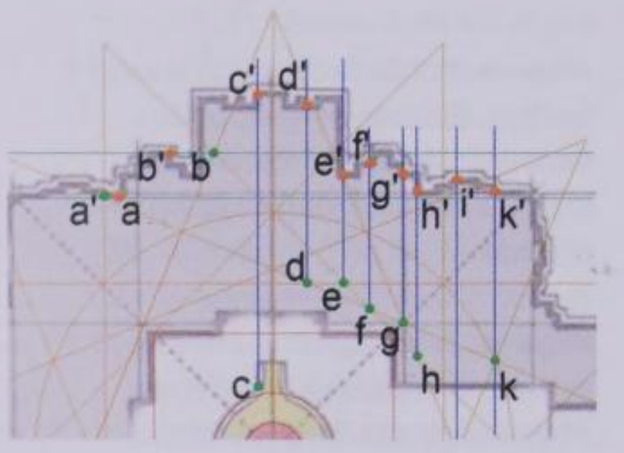


Figure 7.15 Brahmeshvara temple, Bhubaneshwar, Orissa. Intersection points (*Marmas*), possibly define the intricate modulations in profile of *bhadra, pratibhadra* and *karna* edges of the sanctum.



7.1.6 Geometrical Relationship between the prasada and the mandapa

The eighth square which defines the external dimensions of the *prasada,* when rotated at 45°, has the vertical axis '8x - 8x'.The similar square originating from the center of the *mandapa* has the vertical axis '8y-8y'. The '8x - 8x' square's corner, lies on the center of the side of the seventh square of the *mandapa*. Similarly, the rhombus of the eight square of the *mandapa* lies, on the center of the side of the seventh square of the *prasada*, at 'b'. The line denoted by the colour green (Fig. 7.14), which is the 'axis of union' or the line of intersection, could probably also define the 'navel' of the temple anatomy.

7.1.7 The details on the external wall of the prasada and mandapa

The use of pointed stars or rotated triangles can give the further details of the external walls. It is the intersection points of the triangles that on projection further to the peripheries will yield the desired *karna, pratiratha* and the *bhadra* details (Fig.7.15).

For the purpose of analysis we draw on the sixth circle a sixteen-pointed star. Vertical and horizontal projections are drawn from the intersection points (*marmas*), 'a', 'b', 'd', 'e', 'f', 'g', 'h', 'i' and 'k' (Fig. 7.15-7.16). Intersection point 'a' gives the corner point of the *karna* 'a''. Intersection point 'b' gives the external edge of the *ratha* of the *prati-bhadra*. The point 'c'' which denotes the location of the central projection (*ratha*) of the *bhadra* apparently is received from the projection of the pedestal at point 'c'. Another projection point of the *bhadra* at 'd'' is received from point'd'. The extreme edge of the *bhadra* (*raha* in orissa) is

the projected point of the *marmas* 'e'. Similarly, intersection points 'f', 'g' and 'h' received from the intersection of the pointed stars/ triangles drawn on the sixth circle will give projection points 'f'', 'g'', 'h'' of the *prati-ratha*. Point 'i'' and point 'k'' are the relevant points of the *karna* and its *karna-ratha* (Fig.7.15).

A similar sixteen-pointed star is drawn on the sixth circle of the *mandala*. Here again we will note the importance of the intersection points of the triangles (Fig. 7.16). Point 'a' will give the edge of the *pratiratha* at point 'a''. This point 'a'' can also be received from the projection of the tip of the triangle at 'a'''. The point 'b' will give 'b'' the extreme edge of the *bhadra* of the *mandapa*. The flanking point 'c'' of the edge of the *bhadra* will be received from 'c'. The edge of the projection in the niche in the *bhadra* (*rathika*), 'd'' will be projected from the *marmas* 'd'. The point of the triangle at 'e' will give the edge of the central *ratha* in the *bhadra* at point 'e''.

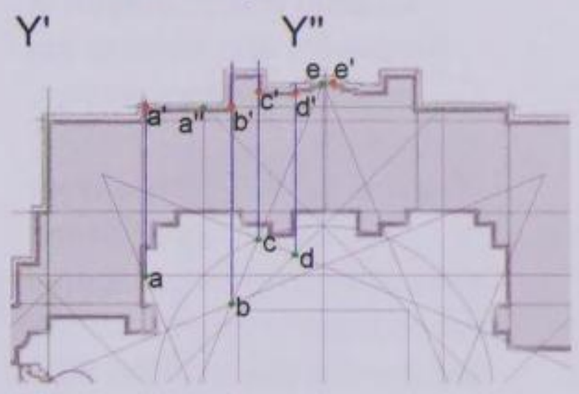
7.1.8 The relationship between the temple and its ancillary shrines

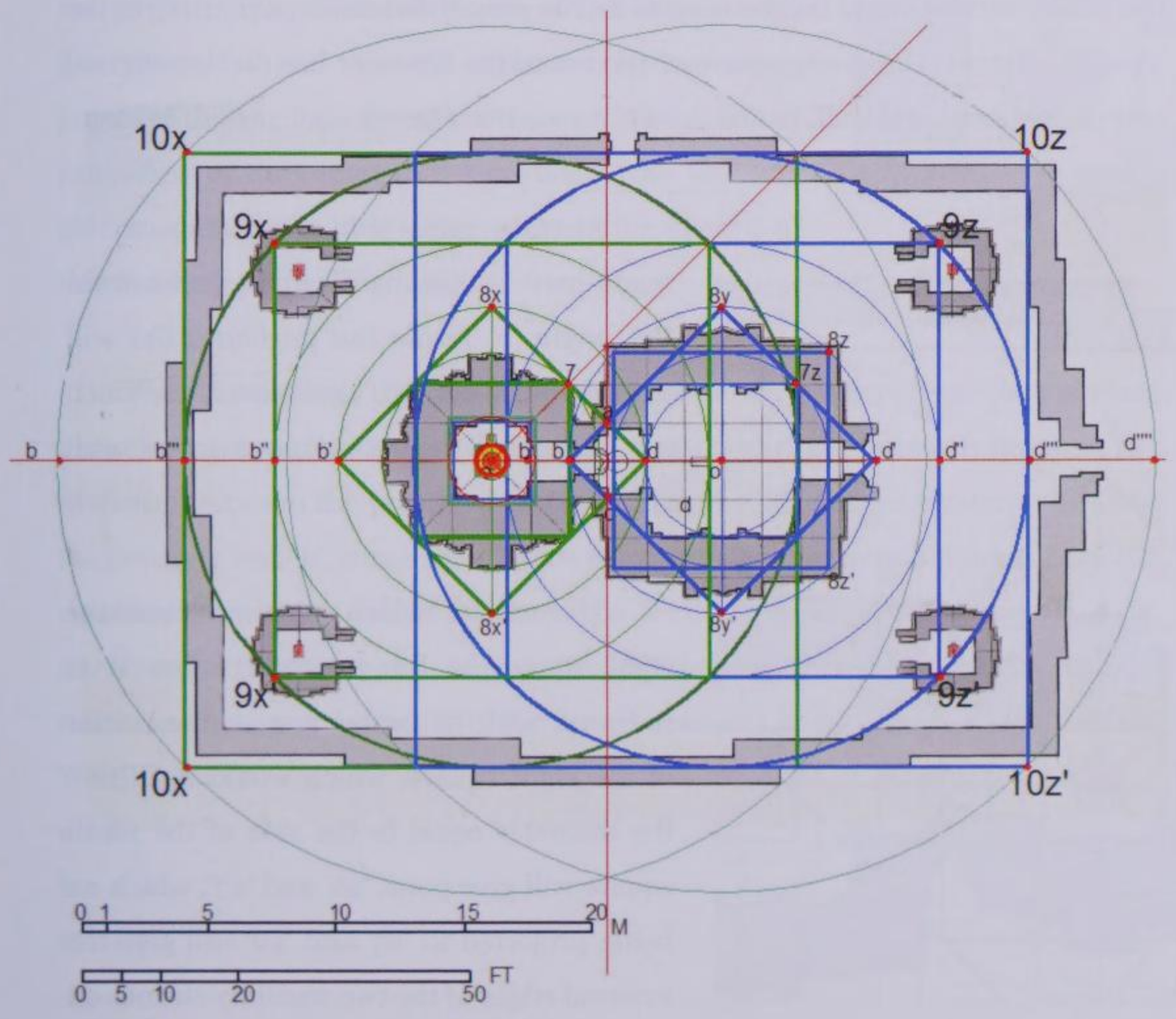
Another important observation in attempting to create a defined relationship between the *prasada* and the *mandapa* also raises interesting placement of

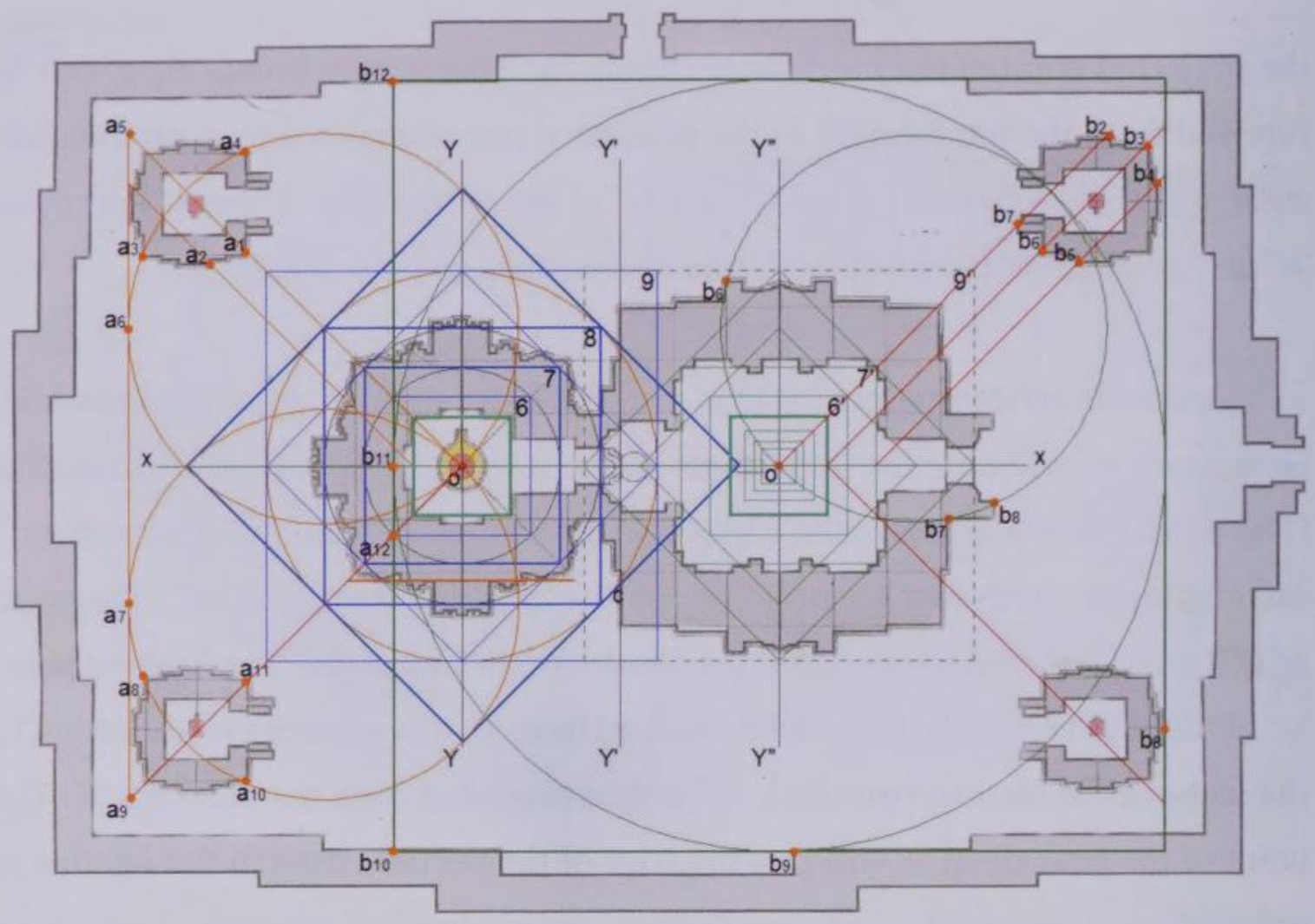
From top to bottom

Figure 7.16 Brahmeshvara temple, Bhubaneshwar, Orissa. Intersection points (*Marmas*), possibly define the intricate modulations in profile of *bhadra, pratibhadra* edges of the *mandapa*.

Figure 7.17 Brahmeshvara temple, Bhubaneshwar, Orissa. Location of the *karna* edge of the *mandapa* is defined by the intersection of the 'line of union' and the diagonal ray originating from the center of the *garbhagriha*. The relationship between the temple and its ancillary shrines is also established with the help of SCS's ninth square. The location of the peripheral wall can also be established with the help of SCS's tenth square.



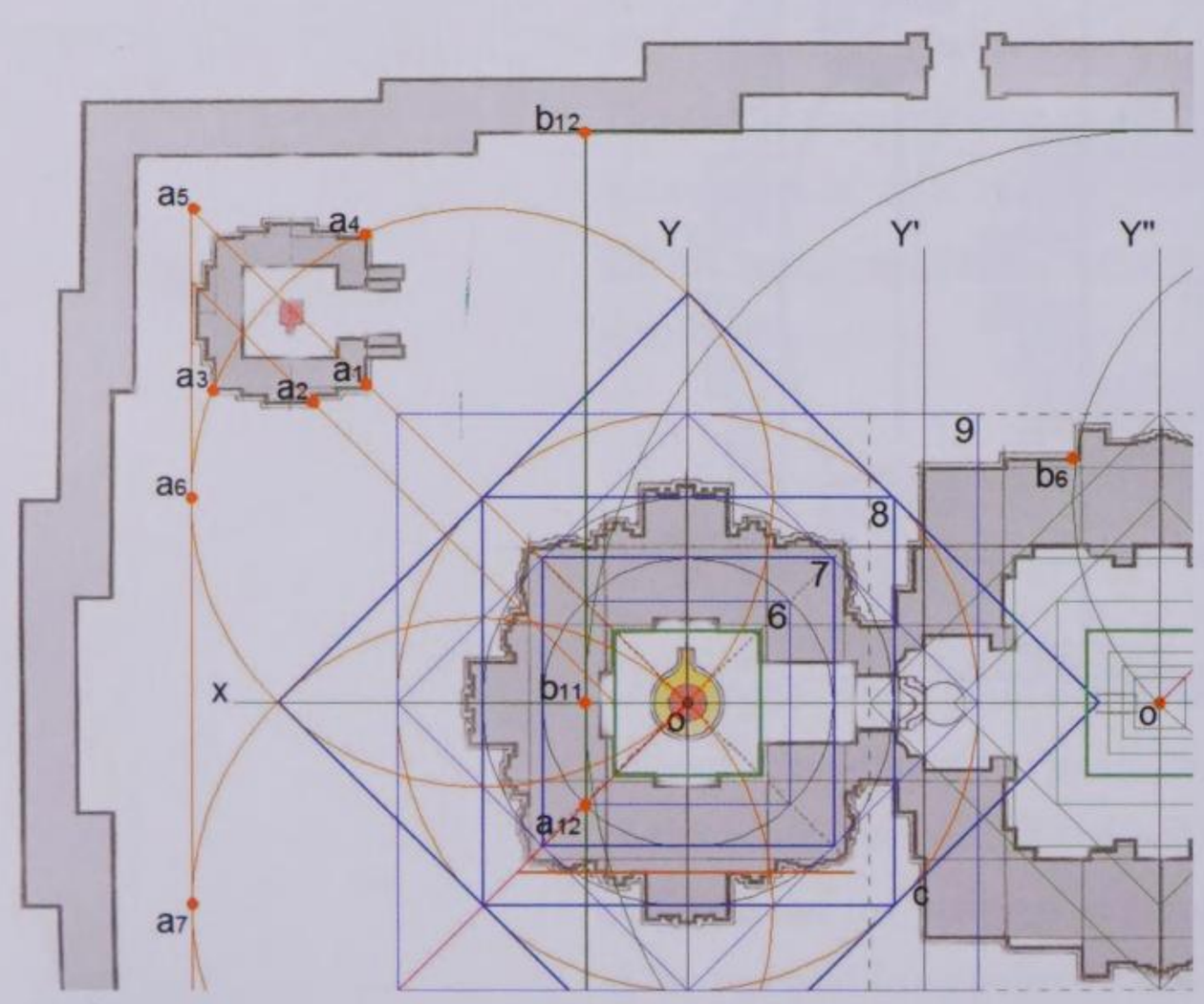




From top to bottom
Figure 7.18 Brahmeshvara temple, Bhubaneshwar, Orissa. The governing diagonal rays originating from the center and the mid points of the SCS squares of the *garbhagriha* and the *Mandapa* define the location and proportion of the *bhadra* and *karna* of the ancillary shrines.

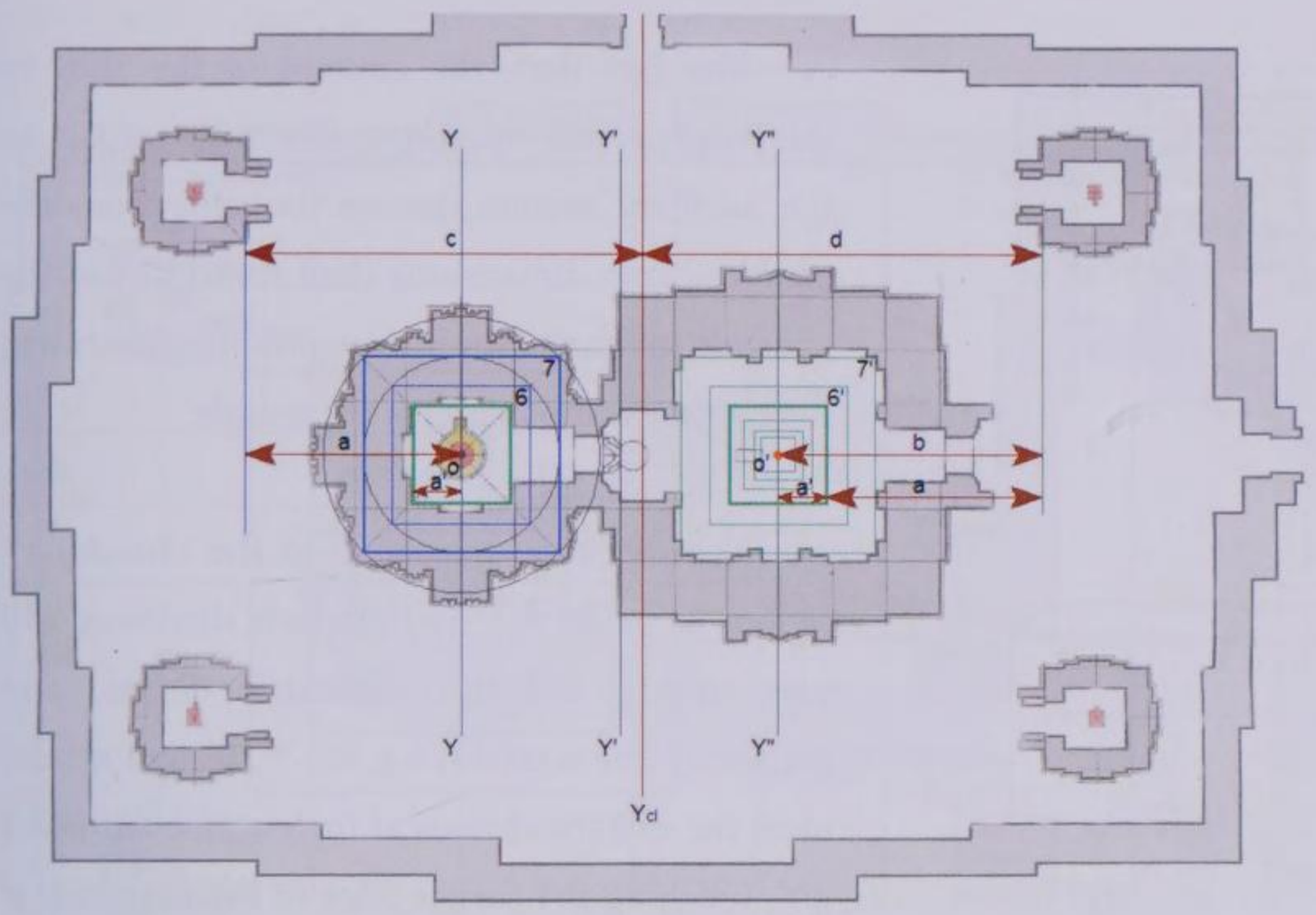
Figure 7.19 Brahmeshvara temple, Bhubaneshwar, Orissa. The governing diagonal rays originating from the center and the mid points of the SCS squares of the garbhagriha help define the location of the bhadra and karna of the ancillary shrines closer to the prasada in the west.

measurement points for the remaining parts of the architectural composition. The ninth square of the *prasada* gives us point '9x' which defines the inner sanctum of the ancillary shrines and concurrent tenth square gives us the external edge of the peripheral wall. Although, there is an apparent shift of the eastern external wall, the reason for this could be, the need to fix the overall dimension according to the '*vyayas*' system. The tenth square of the *mandapa* however lies on the internal side of the peripheral wall.



Another important observation to be made here is that the diagonal drawn from the origin 'o' inside the *garbha-griha* will pass through point '7' and also then touch the corner of the *mandapa* external wall (Fig.7.17).

The circle, which circumscribes the eight square of the *prasada,* when it is redrawn, with its center now at the corner of the eight square, which would also have the diameter equal to the side of the ninth square will give point 'a6' and 'a7', which on being projected to 'a5' and 'a9' will give the external edges of the two ancillary shrines on



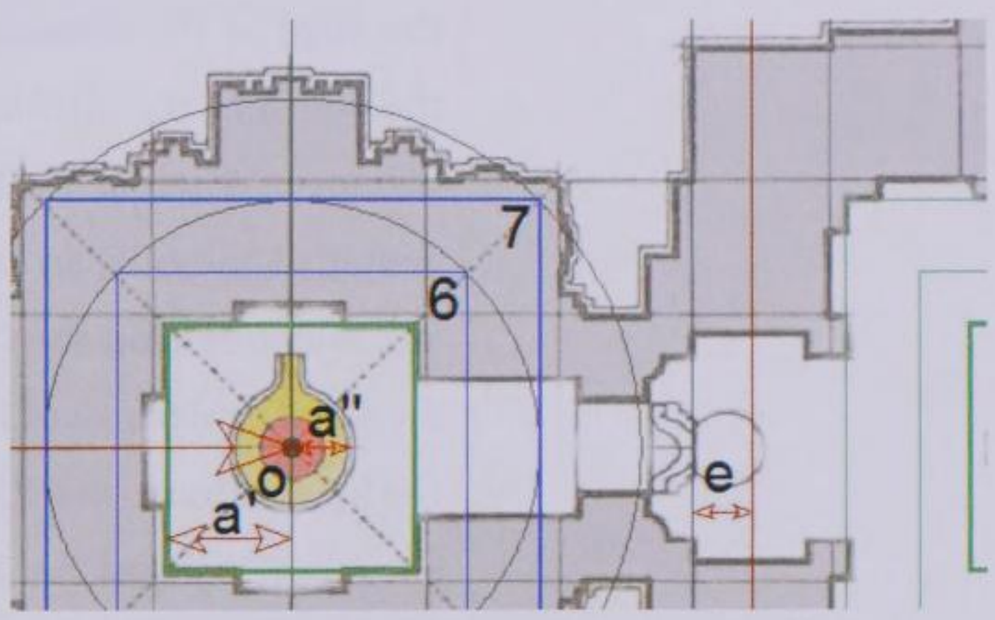
Left

Figure 7.20 Brahmeshvara temple, Bhubaneshwar, Orissa. The amount of the shift in the length at the *mandapa* side, with respect to the ancillary shrines, derives its value from, the *garbha-griha* dimensions (half its width = a') of the *prasada*.

Bottom

Figure 7.21 Brahmeshvara temple, Bhubaneshwar, Orissa. The distance between the edge of the *Mandapa* wall and the 'line of union' is equal to half the diameter of the yoni-*pitha* (a'' = e).

the west (Fig.7.18) These circles will pass through 'a3', 'a4', 'a8' and 'a10', which are the corners of the *karnas* of these two shrines. Also it is to be noted that the diagonal projection of the center point of the lingam in the *garbha-griha* on the west side of the *prasada* will give points 'a1' and 'a11' the other two *karna* corner points of the ancillary shrines in the west. The diagonal projection of the center of the *garbha-griha* wall will give the point 'a2' which is the corner of the *bhadra* of this ancillary shrine (Fig.7.19).

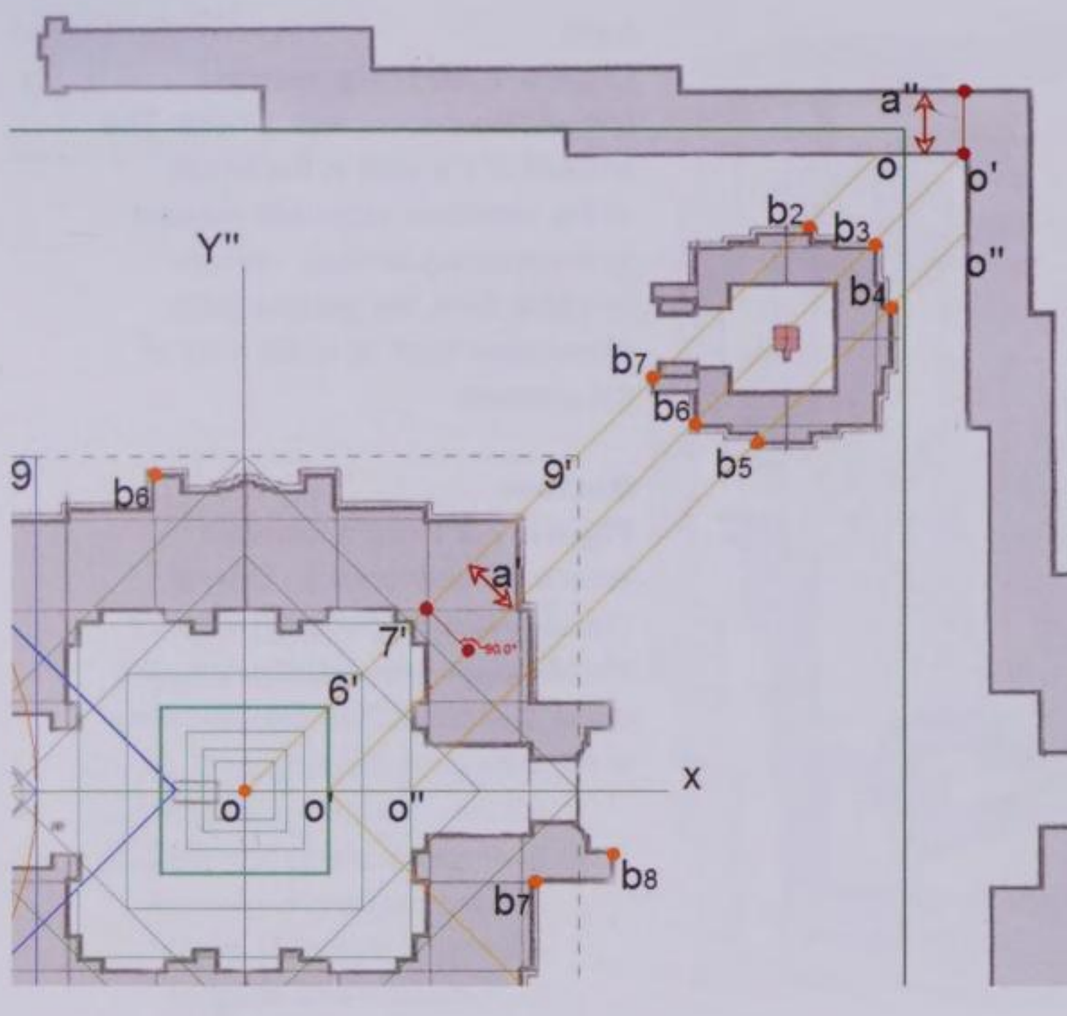


The relationships that can be established for the other two ancillary shrines in the east, are different from that for the western shrines, primarily because, the distances between the projected distance from the edge of the western shrine to the *prasada* wall 'a', is not equal to the projected distance between the edge of the eastern shrine to the wall of the *mandapa* 'b', i.e. where a′ = half the width of the *garbh-griha* (Fig.7.20) and where a'' = half the width of the lingam pedestal, e = difference between the center of the temple complex length and the axis of union Y'Y'(Fig.7.21)

$a \neq b$

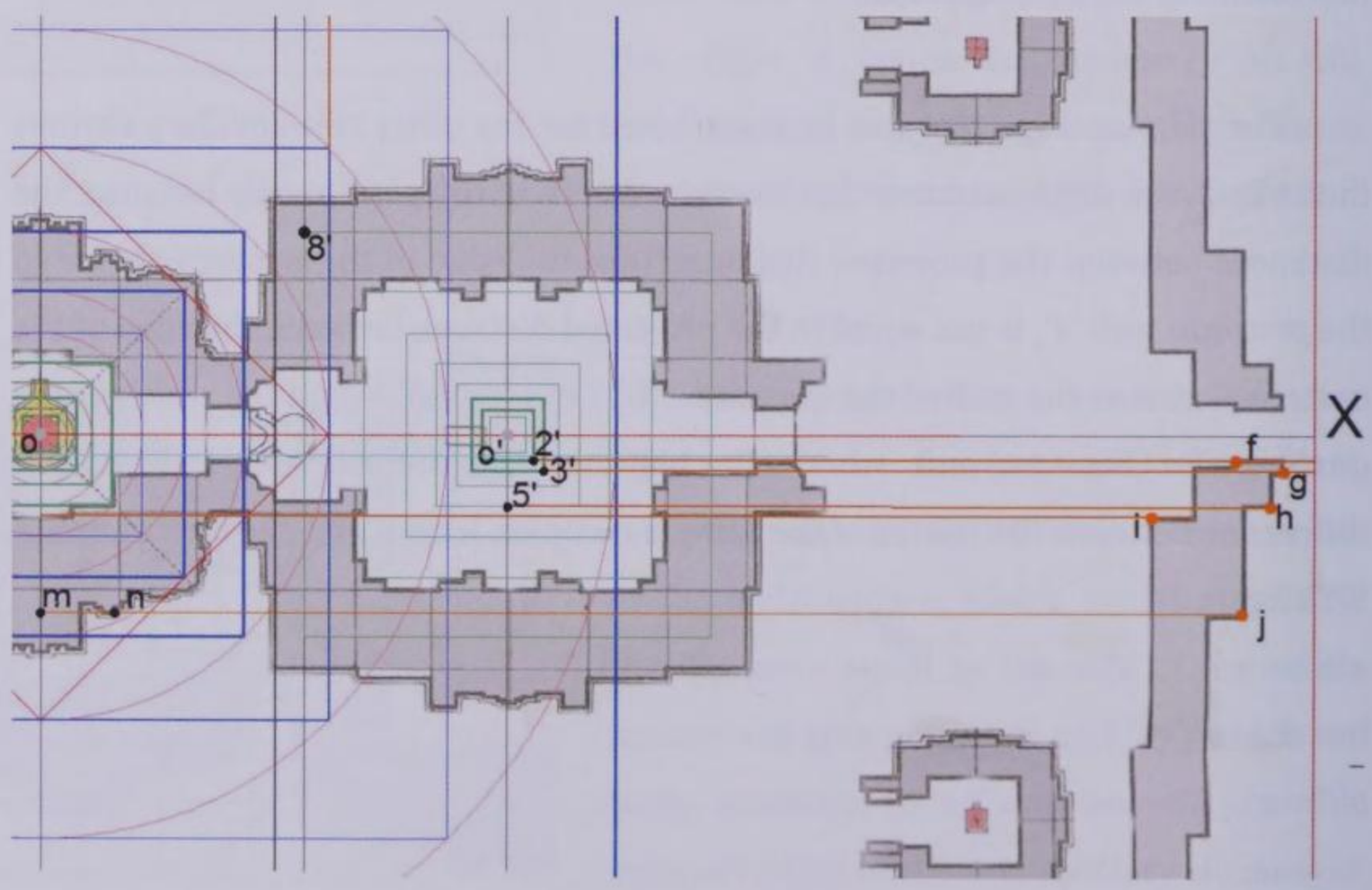
$b = a' + a$

$a'' = e$



The fact that, the amount of the shift in the length at the *mandapa* side with respect to the ancillary shrines derives its value from the *garbha-griha* dimensions (half its width) of the *prasada* reinforces the inter-relationship between the two key components of the temple.

The diagonal projection of the *mandapa*'s center point in the northeastern direction will pass through all the concentric circles, and corners of the squares, e.g. 6′, 7′, 8′ and 9′ and meet the eastern shrines at the entrance at point 'b7', touching the corner edge of the entrance of the *garbha-griha* from the inside continues up to the edge of the *bhadra* of the shrine. Since the shift on the eastern side is half the width of the *garbha-griha* it can seen that the diagonals also shift the same distance. Whereas in the western shrines the *karna* edges are derived from the center of the SCS, in the eastern shrine it is the mid point of the *garbha-griha* 'o'', which lies on the 'XX' axis give us these points 'b6' and 'b3' (Fig.7.22). The diagonal projection of the mid point of the seventh square 'o′′' which also lies on the longitudinal axis 'XX' will give the corner points of the *bhadra* of the subsidiary shrines at 'b5' and 'b4'.



From top to bottom

Figure 7.22 Brahmeshvara temple, Bhubaneshwar, Orissa. The width of the wall is equal to, the perpendicular distance between the diagonal projections from the center of the *mandapa* and the mid point of Fourth Square of the SCS.

Figure 7.23 Brahmeshvara temple, Bhubaneshwar, Orissa. The modulations of the eastern boundary wall are direct projections of points of the SCS.

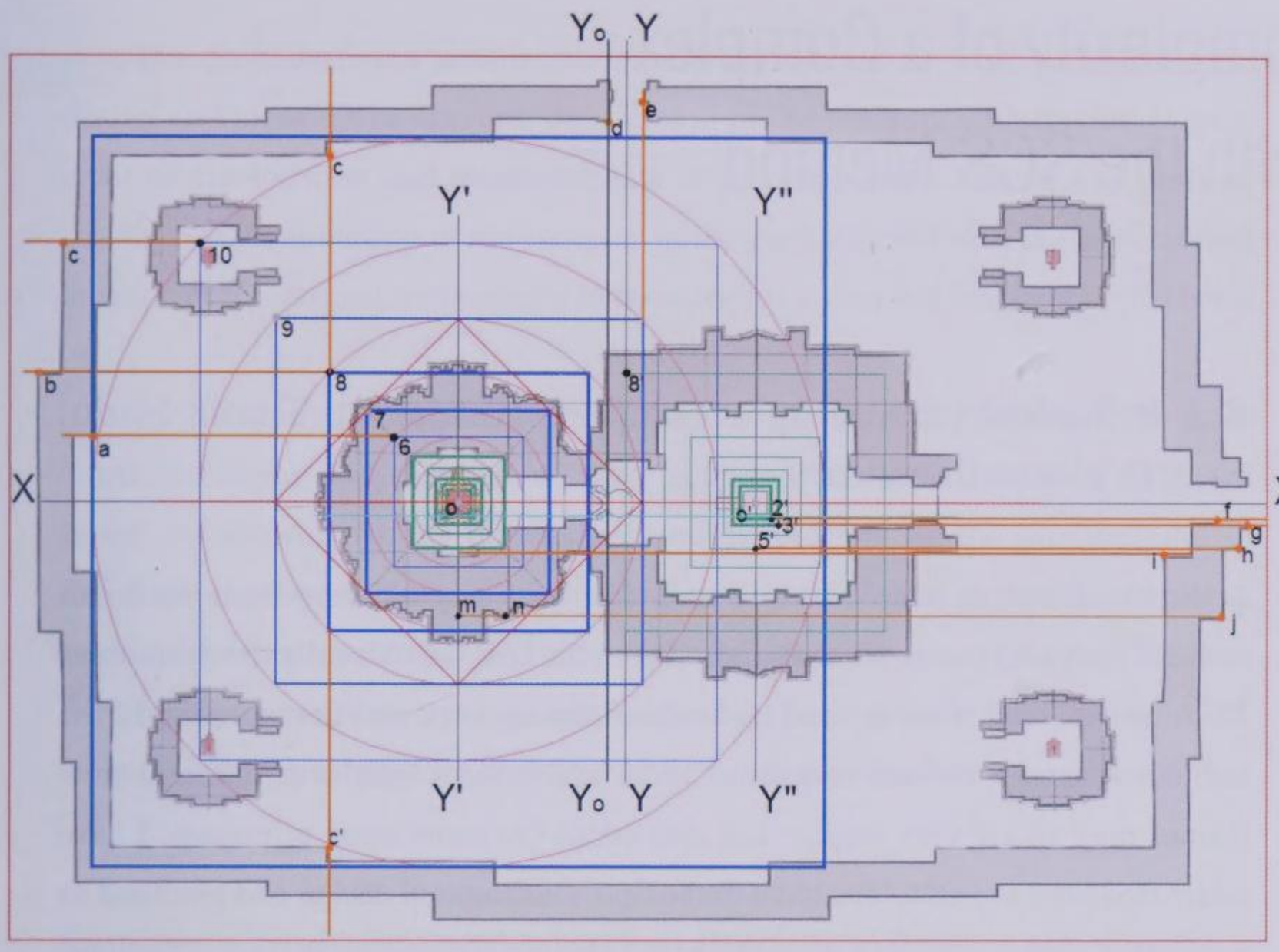


Figure 7.24
Brahmeshvara temple, Bhubaneshwar, Orissa. The modulations of the all the peripheral

The width of the wall 'a‴' is equal to the perpendicular distance 'a″', which is the distance between diagonal projections from the center 'o' and the center of the *garbha-griha* wall 'o″'.

Hence, a′ = a″.

of the SCS which corresponds to the width of the *garbha-griha* inner wall (a′ = a″).

Hence, a′ = a″.

The modulations of the boundary wall are direct projections of some points of the plan (Fig.7.23). The projection of the external wall of the *pratiratha* point 'n' gives point 'j', the dimensions of the fifth square of the SCS will give point 'h', the third square of this sequence will give point 'g'. The second square, which is also the inscribed square of the lingam pedestal, will give the point 'f'. The recess in the *garbha griha* wall lying on the fifth square of the SCS will project the point 'i', (it is to be noted that the fifth and sixth governing square coincide with the corner most point of both the *garbha griha* and the *mandapa* respectively and not with the edge of the recess walls.)

The point 'a' is received from the sixth square and the external points 'b' and 'c', will be governed by the eight and the tenth square respectively (Fig. 7.24).

8-Solving the Complexity of a Complex Temple Layout with the SCS Method

Figure 8.1 Map of Tanjavur, Tamil Nadu (adapted after George Michell)

8.1 Brihadeshvara temple complex, Tanjavur, Tamil Nadu, ca.A.D. eleventh century

Is the North Indian temple architecture (*Nagara*) very different from the South Indian (*Dravida*) one or for that matter from the Orissan? Visually the differences are numerous but if we try and understand the concept and the planning of the temples from the various regions of India which were built over different time frames they all are very similar and also adopt the same basic principles. I have addressed here a need to establish the temple's conceptual design and planning as a universal phenomenon irrespective of the obvious differences in their elevations, regional influences for the façade treatment and not to forget the elaborate Sanskrit terminology applied to address it.

Temple Complex,Thanjavur, Courtesy Gerard Foekema

The Brihadeshvara temple complex is considered as "vast in its concept, design and form"[10] The size and the location of the sanctum with its Siva lingam gives us the location and measurements of the other parts. All the key parts of the viz., *Ardhamandapa* of the complex in the *garbhagriha* with the unperceived location of the various components of the complex layout has been unraveled here.

In this study I am presenting the detailed geometrical analysis of the main Southeast facing Rajarajeshwara shrine (*vimana*) dedicated to Shiva. (Fig.8.4) It will be shown that the dimensions and proportions of the *garbhagriha* of the Rajarajeshwara *vimana* governs the dimensions of its *ardhamandapa*, *mahamandapa*, *mandapa* and the flight of steps in front (Fig.8.5) Besides defining its own geometry it generates the locations and the dimensions of all the surrounding subshrines like the Nandi *mandapa* which is located in front of

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10 K.R.Srinivasan, 'Middle Colanadu style, c. A.D. 1000-1078, Colas of Tanjavur: Phase II' in *Encyclopaedia of Indian Temple Architecture: South India, Lower Dravidadesa*, ed. Michael W. Meister, coordinated M.A.Dhaky, (New Delhi and Philadelphia, American Institute of Indian Studies, University of Pennsylvania Press, 1983), pp. 222-60, p.234

Top
Figure 8.2 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur, Tamil Nadu, ca. A.D. eleventh century (courtesy AIIS)

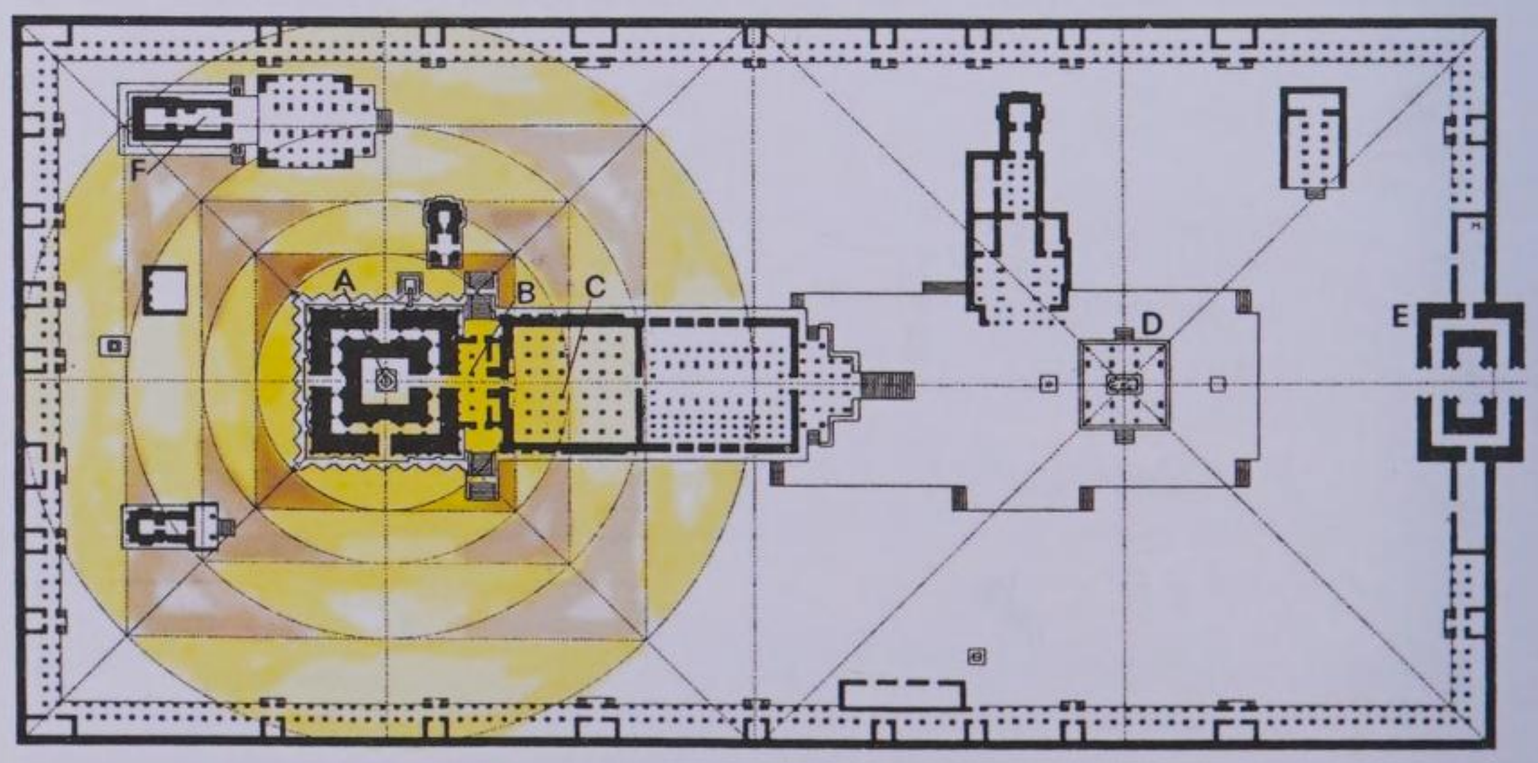
its flight of steps at 400'distance from the center of the *vimana* and also the Candeshvara temple which is located north of the main *vimana*. All the other sub shrines and the *gopura* are also part of the SCS of the main Rajarajeshwara *vimana*.

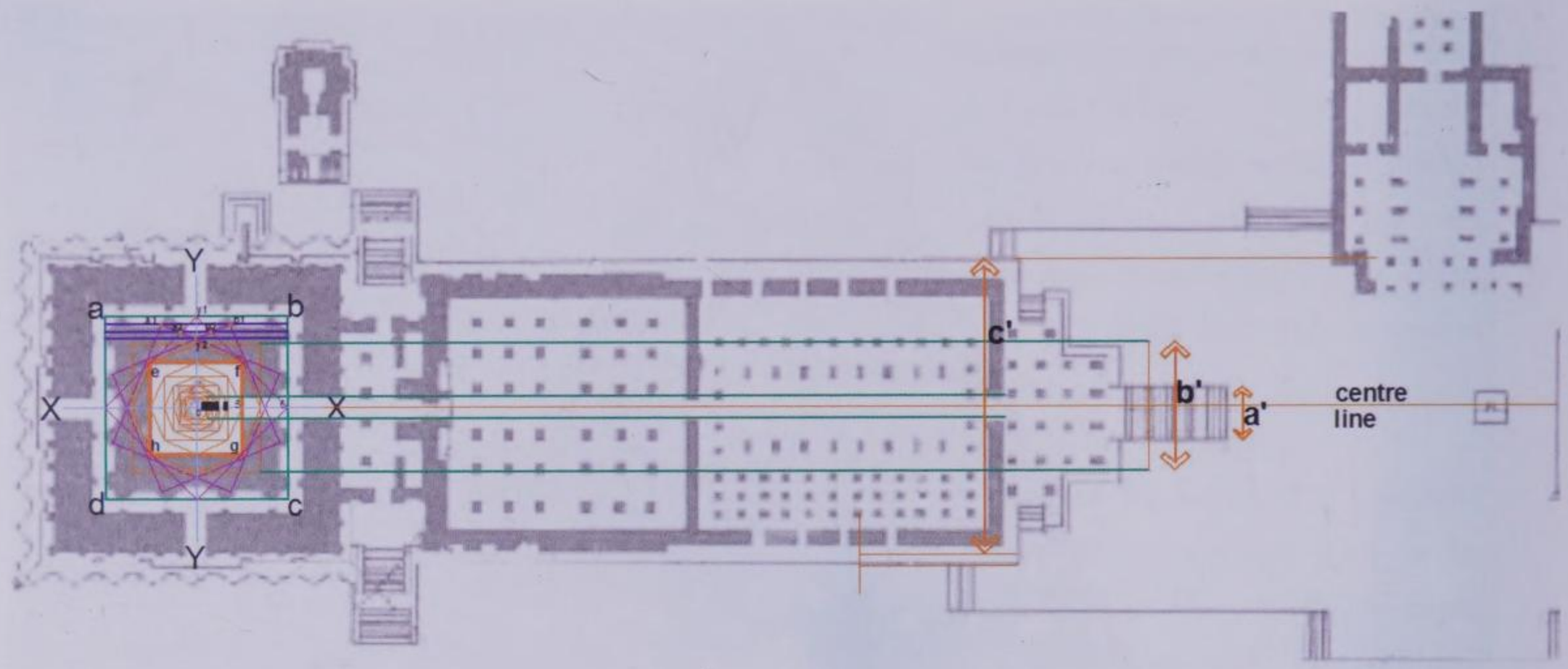
In the Fig.8.6 the SCS has being applied. The originating circle is the Shiva-*linga* in the center. The inner wall of the sanctum (*antarabhitti*) coincides with fifth circle 'e-f-g-h'. The sixth square when rotated will give the *marma* 'a2' and 'b2' which on projection will give us the wide central niche for divinity (*devakosthas*) opposite the *bhadra* doorways. The two other niches flanking the central *devakostha* can be derived from the projected points 'a1' and 'b1'. The projected line form the point 'y1' will govern the edge of the pilasters in the *antarabhitti*.

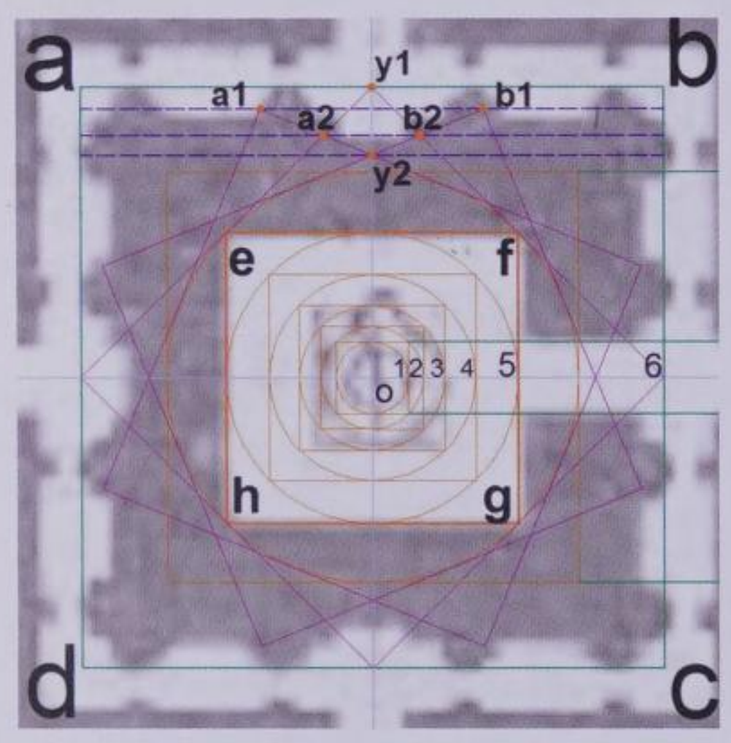
Bottom
Figure 8.3 The ground plan of Brihadeshvara temple Complex, Tanjavur. (courtesy Volvahsen, 1969, p.87)

Facing page
Figure 8.4 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur (courtesy AIIS)

In Fig.8.7, we can note that the pillared *mandapa,* which leads to the flight of steps, has its dimensions based on the sixth square. is equal to'd'. The distance from the start of the *mandapa,* to the inside wall of the *mahamandapa* is also equal to'd'.







Top

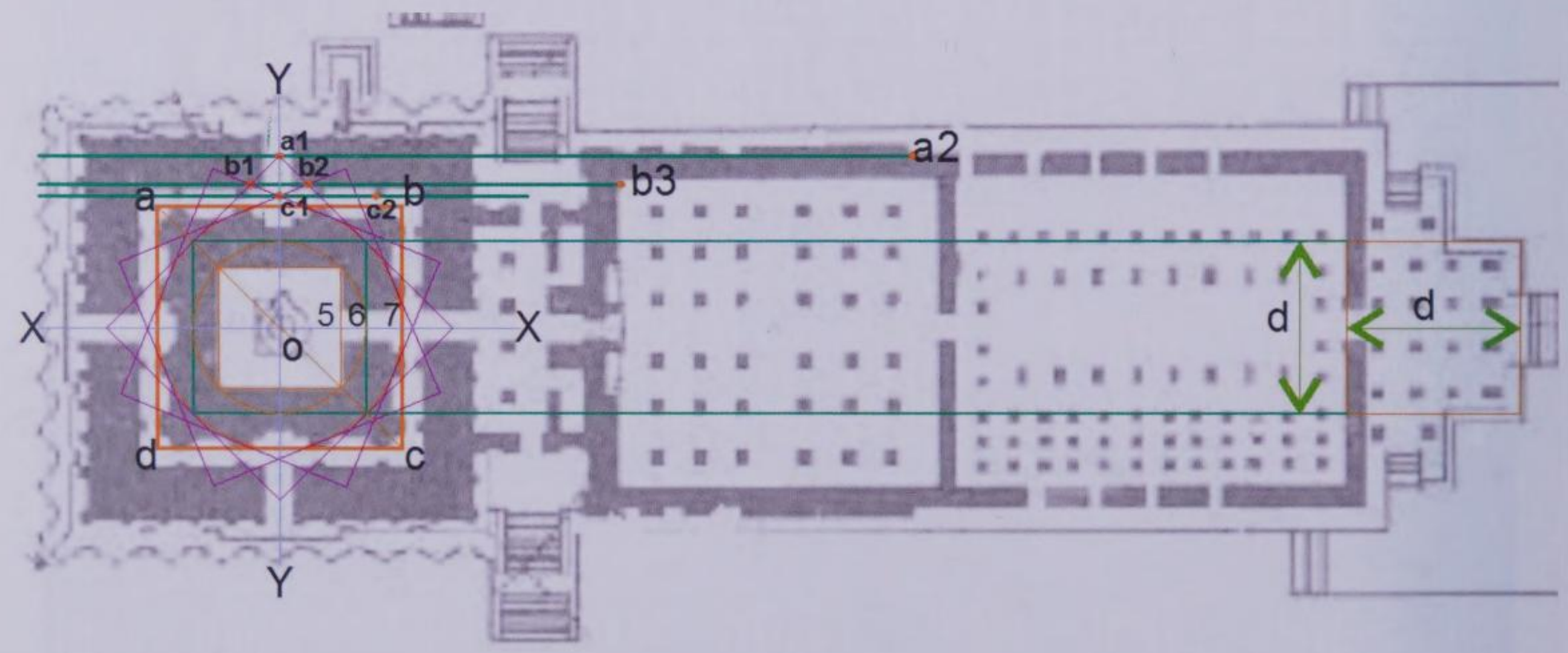
Figure 8.5 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur, ground plan. The dimensions and proportions of the *garbhagriha* of the Rajarajeshwara *vimana* governs the dimensions of its *ardhamandapa, mahamandapa, mandapa* and the flight of steps in front.

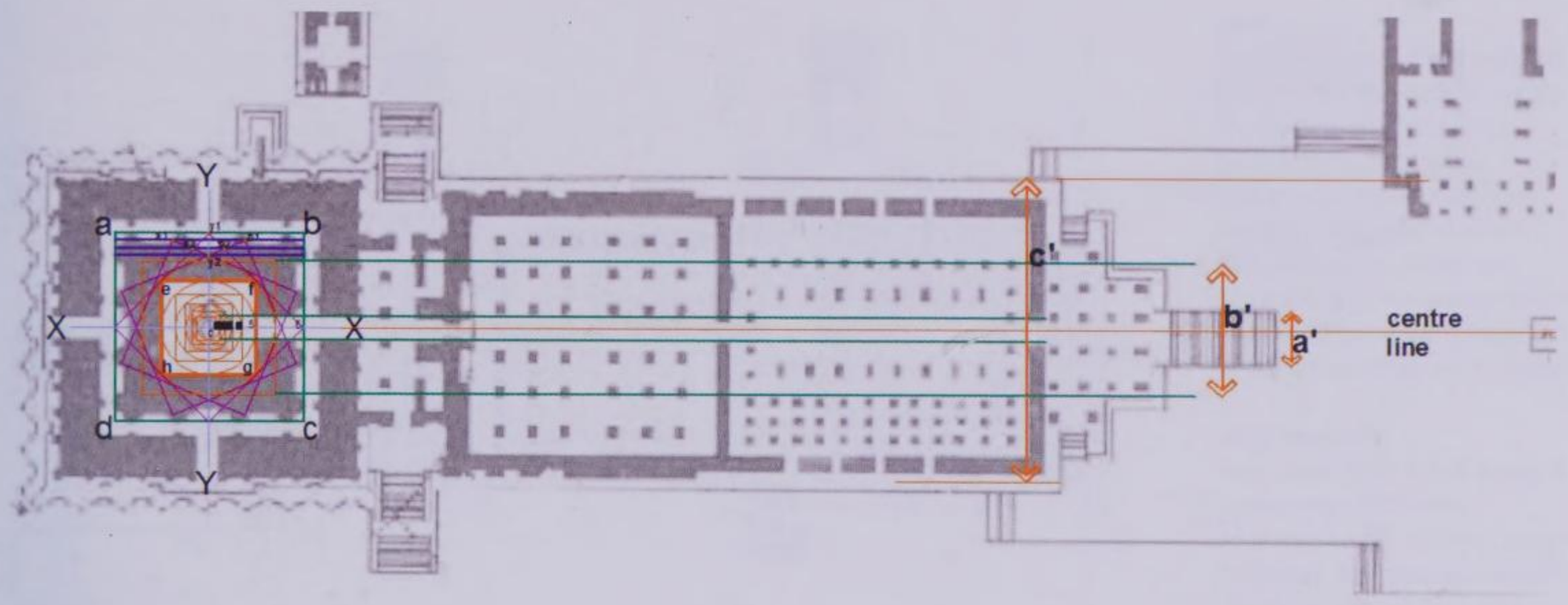
Centre

Figure 8.6 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The originating circle of the SCS is the Shiva-*linga* in the center.

Bottom

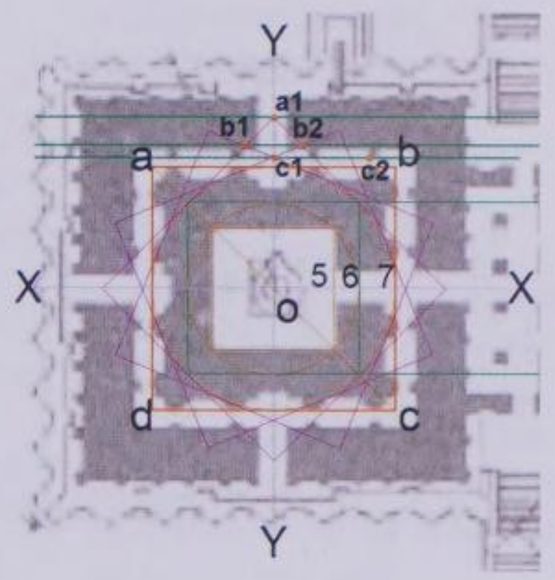
Figure 8.7 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The distance between the *mahamandapa* pillars and the width of the projection in the *mandapa*, is equal to the side of the sixth square.



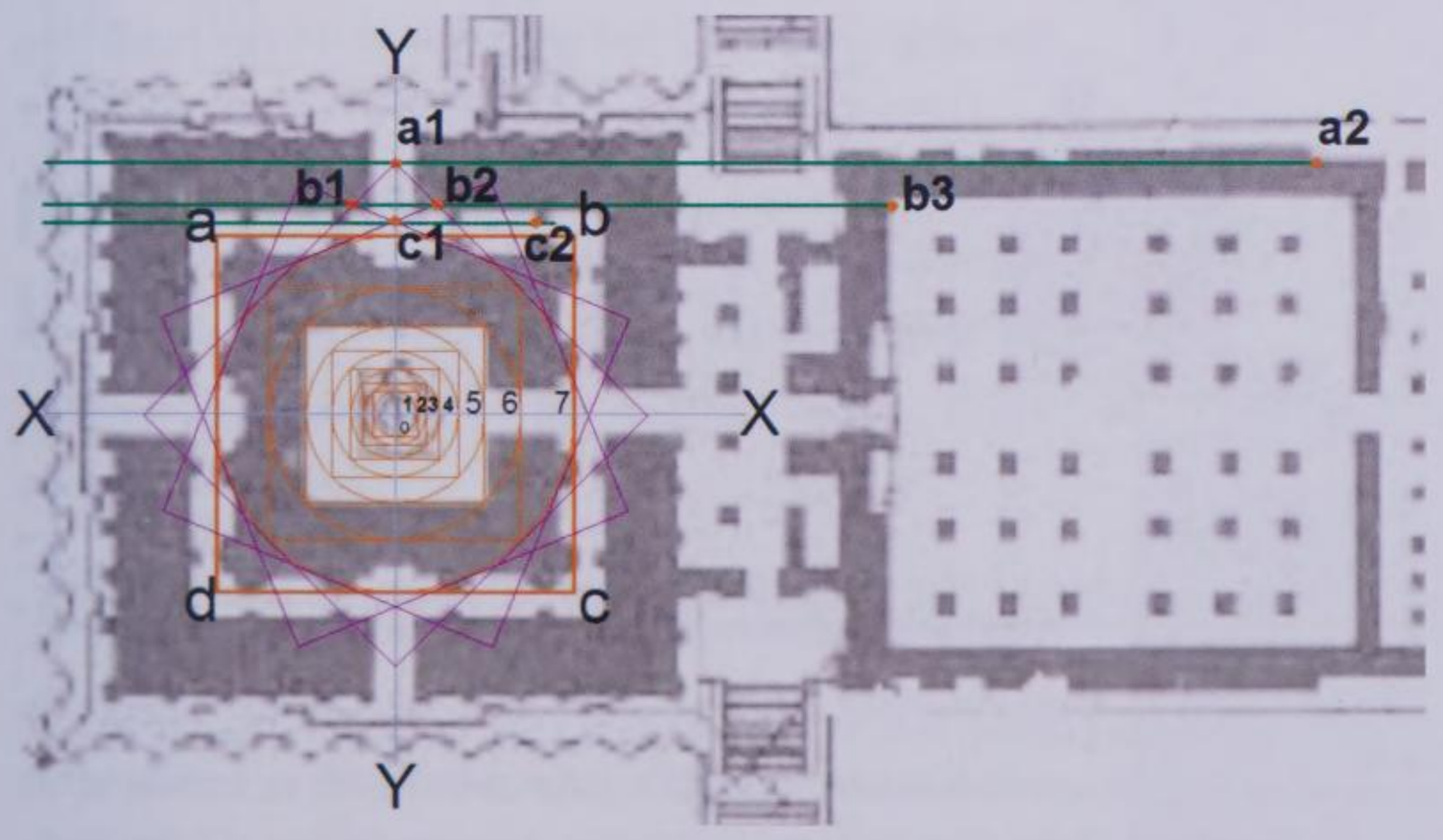


In the Fig.8.8, we can note that the entrance to the *mahamandapa,* is equal to the first square of the SCS. If we construct another rotated square of the seventh square of the SCS, we get *marmas* 'a1', 'b1','b2' and 'c1'. The projections of the *marmas* 'b1' and 'b2', will define the inside of the exterior wall. The point 'c1' when projected to say 'c2', will define the pilasters on the inside of the outer *garbhagriha* wall (Fig.8.9).

Projecting the points 'b1' and 'b2', further towards the *ardhamandapa,* we can note that it will define the inner side of the *ardhamandapa* wall (Fig.8.9-8.10). Whereas, the projection from point 'a2', will define the inner edge of the wall- recesses.



Top
Figure 8.8 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The entrance to the *mahamandapa*, is equal to the first square of the SCS.



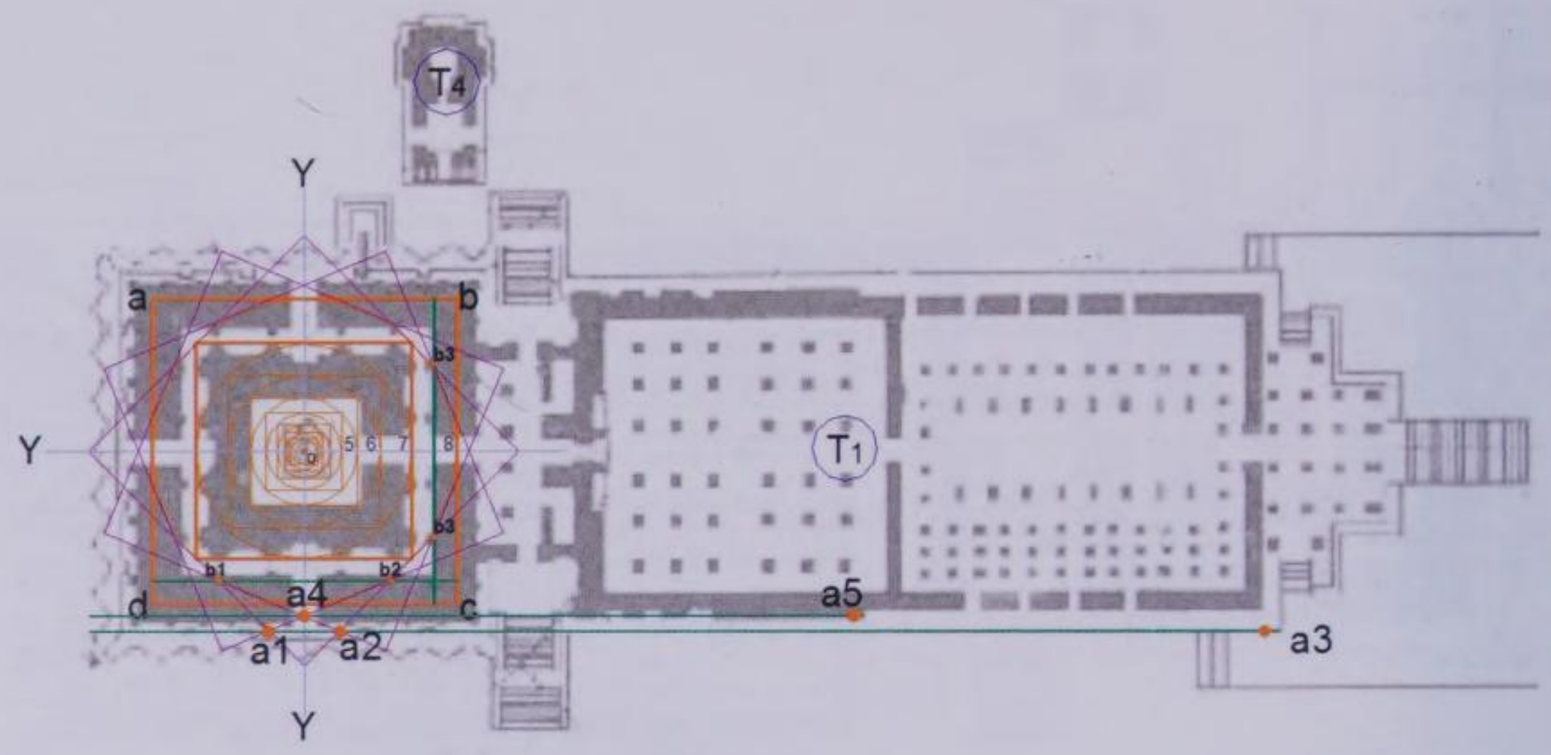
Centre
Figure 8.9 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The projections from the *marmas* of the rotated seventh square of the SCS, will define the inside, as well as, the inner pilasters on the outer *garbhagriha* wall.

Bottom
Figure 8.10 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. Location of the inner side of the *ardhamandapa* wall, as well as, the inner edge of the wall-recesses.

Top
Figure 8.11 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. External side of the *ardhamandapa* wall and the bottom edge of the combined projected plinth of the *ardhmandapa* and the *mahamandapa*, originates from the *marmas* of the seventh rotated square of the *garbhagriha* SCS.

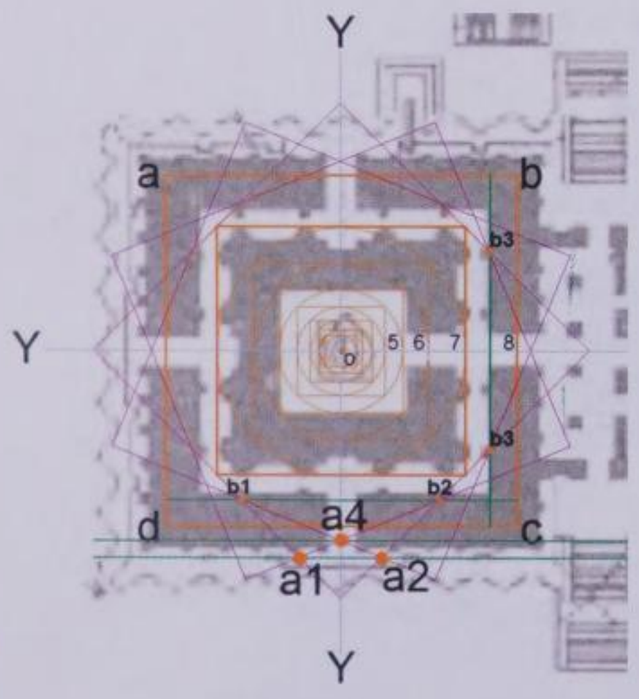
Bottom left
Figure 8.12 Rajarajeshwara shrine, Brihadeshvara temple,Tanjavur. The location of the internal and external edges, of the outer garbhagriha wall.

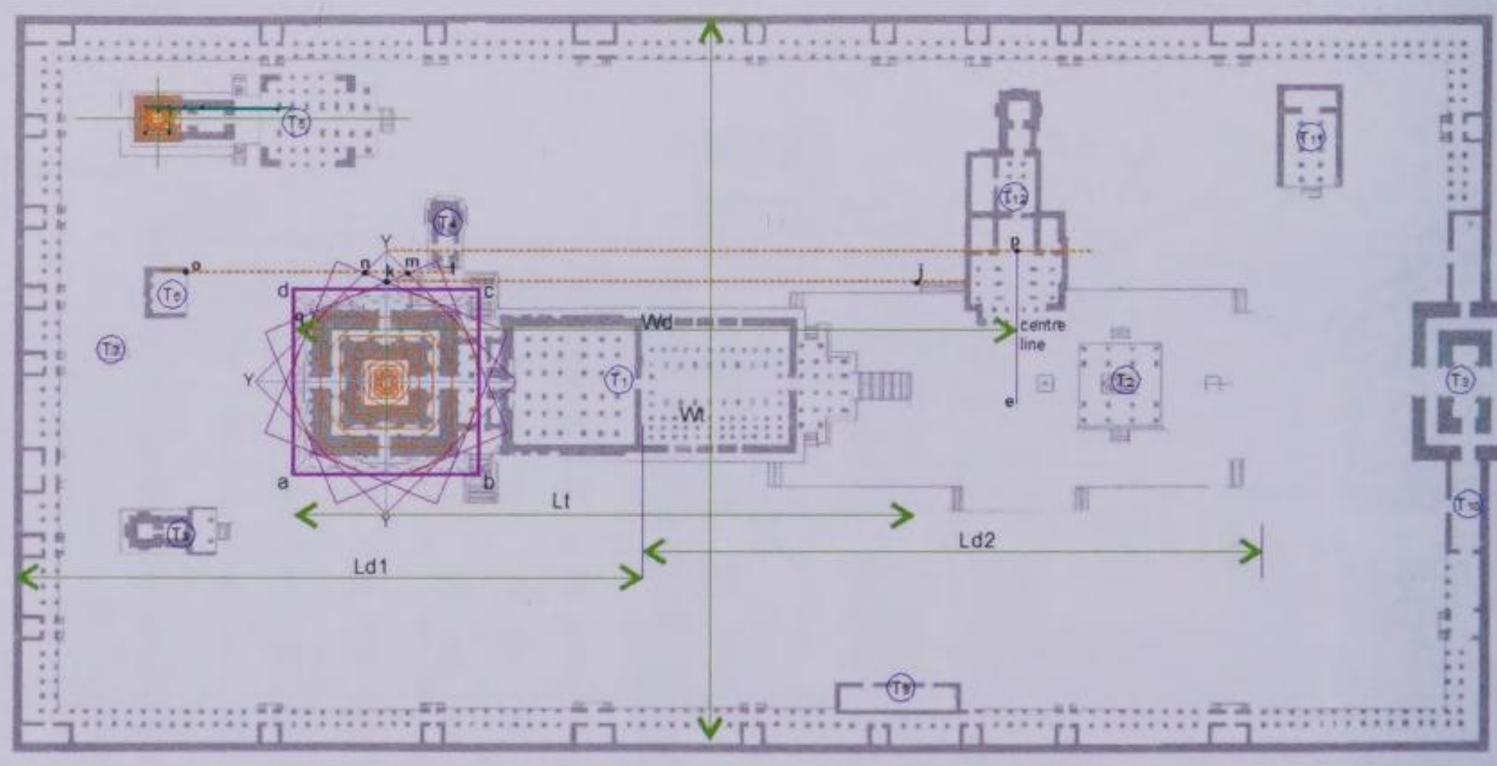
Bottom right
Figure 8.13 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The distance from the enclosure wall (*prakara*), to the common wall between the *ardhamandapa* and the *mahamandapa* is 'Ld1'. The distance from this wall, to the end of platform, on which the huge, monolithic *Nandi* is seated, in another *Chola* design moulded platform is 'Ld2'. If the length of the temple is 'Lt', then it was found that, Lt = Ld1 = Ld2.



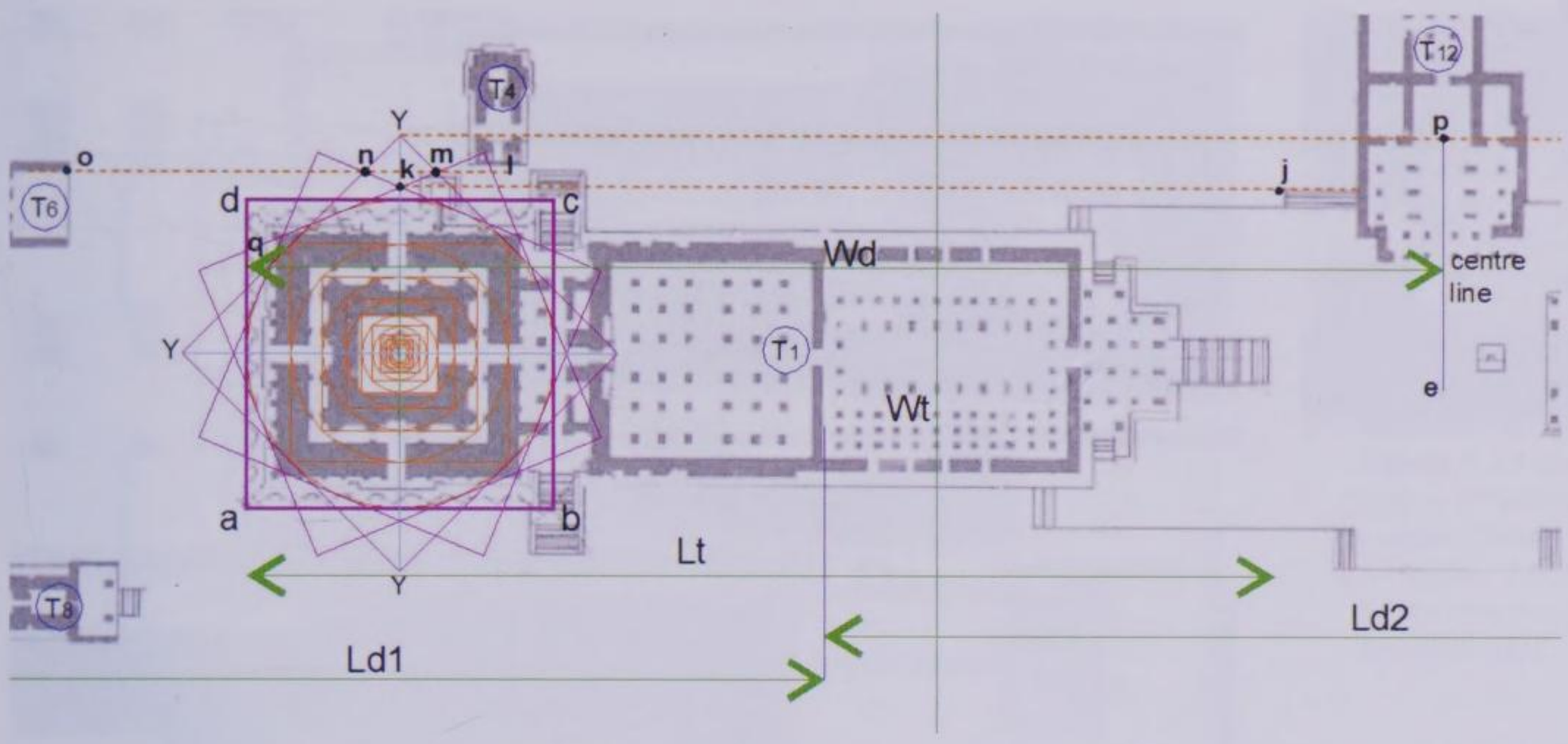
In Figs. 8.11-8.12, we can find that the external side of the *ardhamandapa* wall is the projection from point 'a4'. The bottom edge of the combined projected plinth of the *ardhmandapa* and the *mahamandapa*, originates from the *marmas* 'a1' and 'a2', which generate from the SCS's (garbhagriha) seventh rotated square.

The distance from the enclosure wall (*prakara*), to the common wall between the *ardhamandapa* and the *mahamandapa* is 'Ld1'. The distance from this wall, to the end of platform, on which the huge, monolithic *Nandi* is seated, in another *Chola* design moulded platform is 'Ld2'.[11] If the length of the temple is 'Lt', then it was found that, Lt = Ld1 = Ld2. (Fig. 8.13)





[11] K.R.Srinivasan, 'Middle Colanadu style, c. A.D. 1000-1078, Colas of Tanjavur: Phase II' in *Encyclopaedia of Indian Temple Architecture: South India, Lower Dravidadesa*, ed. Michael W. Meister, coordinated M.A.Dhaky, (New Delhi and Philadelphia, American Institute of Indian Studies, University of Pennsylvania Press, 1983), pp. 222-60, p.239



8.2 Geometry of Candeshvara temple

In the Fig. 8.14, we can see the relationships with the subsidiary shrines 'T4', 'T6' and 'T12' being established.

From top to bottom
Figure 8.14 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationship of the main temple with the subsidiary shrines 'T4', 'T6' and 'T12' can be established.

Next, are a series of drawing for the Candeshvara temple, a contemporary sub-shrine of the main *vimana,* which is located towards its north (Fig.8.15). This temple is an all stone structure.[12] The square plan of the double storied *dvitala vimana* has an *ardhamandapa*.

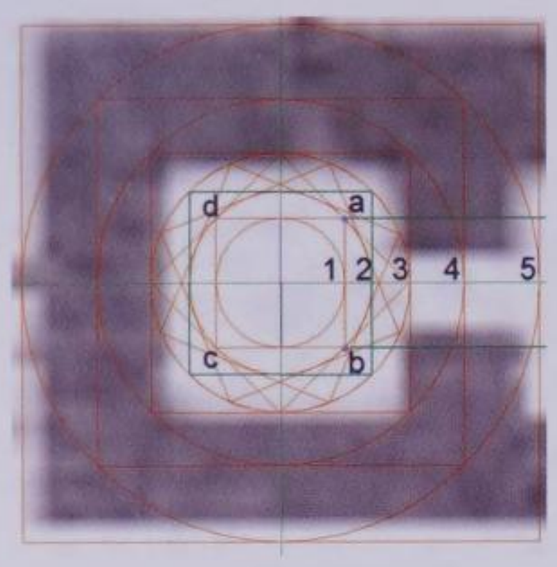
Figure 8.15 Candeshvara temple, Brihadeshvara temple complex, Tanjavur

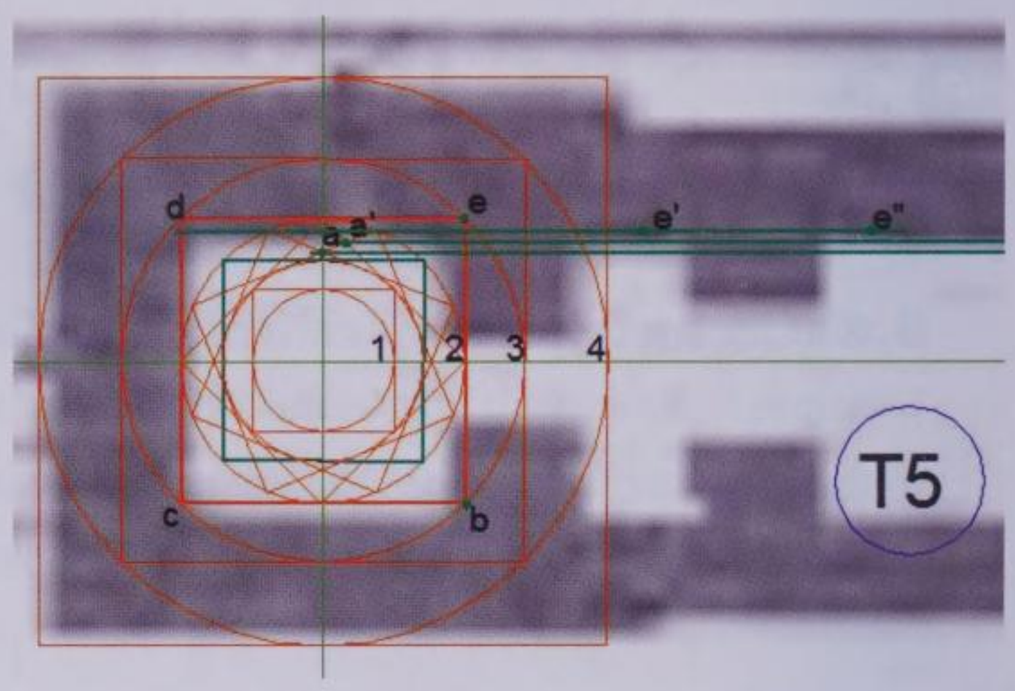
As with the main *vimana* the SCS is drawn on the *garbhagriha* of this temple as well. The third square of the SCS coincides with the *antarabhitti* (Fig. 8.16).

Figs.8.17-8.18 shows the projections, defining the columns of the *ardhamandapa* and the wall of the *antarala*. In the Fig. 8.19 the doorway leading to the *antarala* is defined.

In the Fig. 8.20 we can see that the width of the flight of steps 'g´' can be derived from the projected line starting at the corner of the third square of the SCS which is also

12 ibid., p.240





Clockwise from left top
Figure 8.16 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The third square of the SCS coincides with the *antarabhitti*

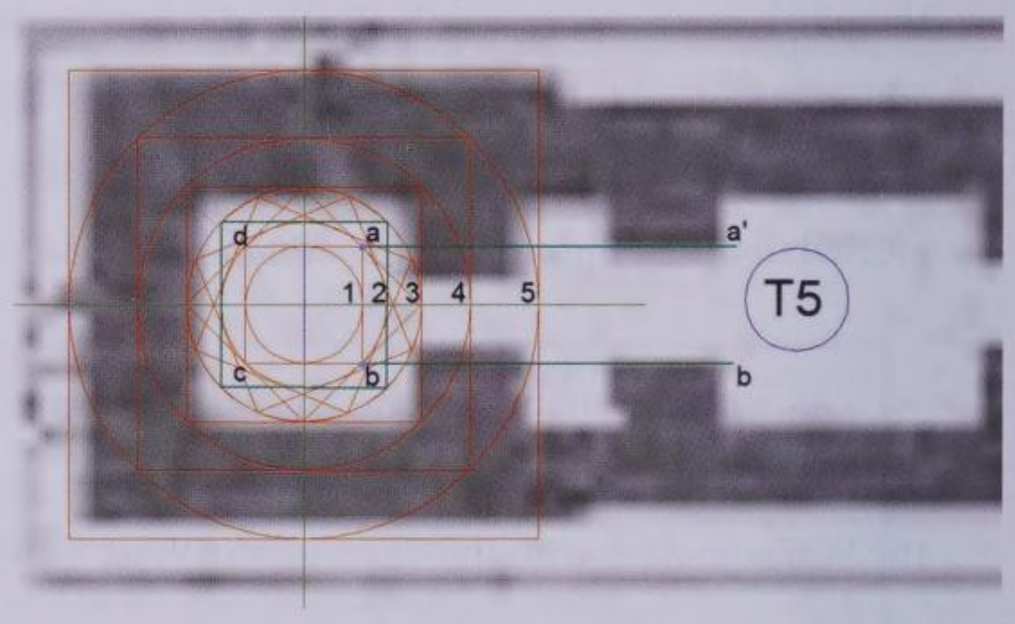
Figure 8.17 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The projections from SCS define the columns of the *ardhamandapa* and the wall of the *antarala*

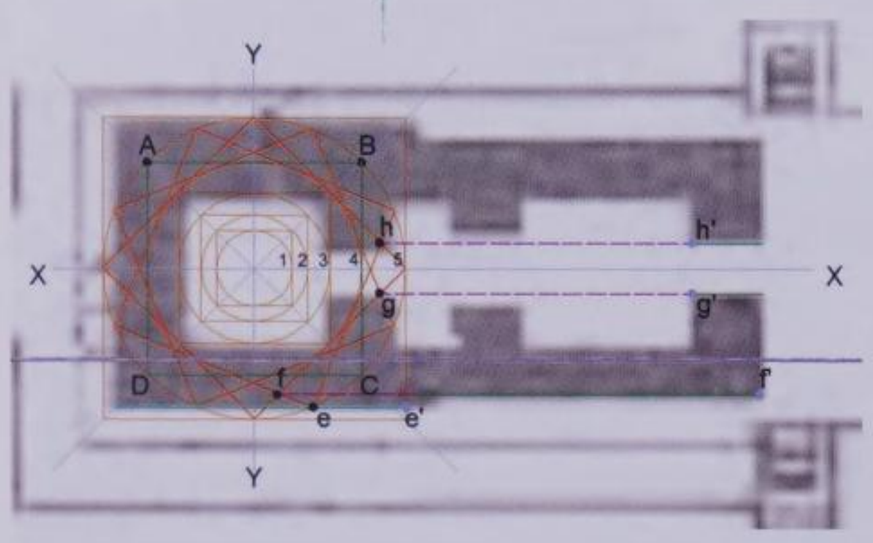
Figure 8.18 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The *marma* projections from SCS, which define the columns of the *ardhamandapa* and the wall of the *antarala*

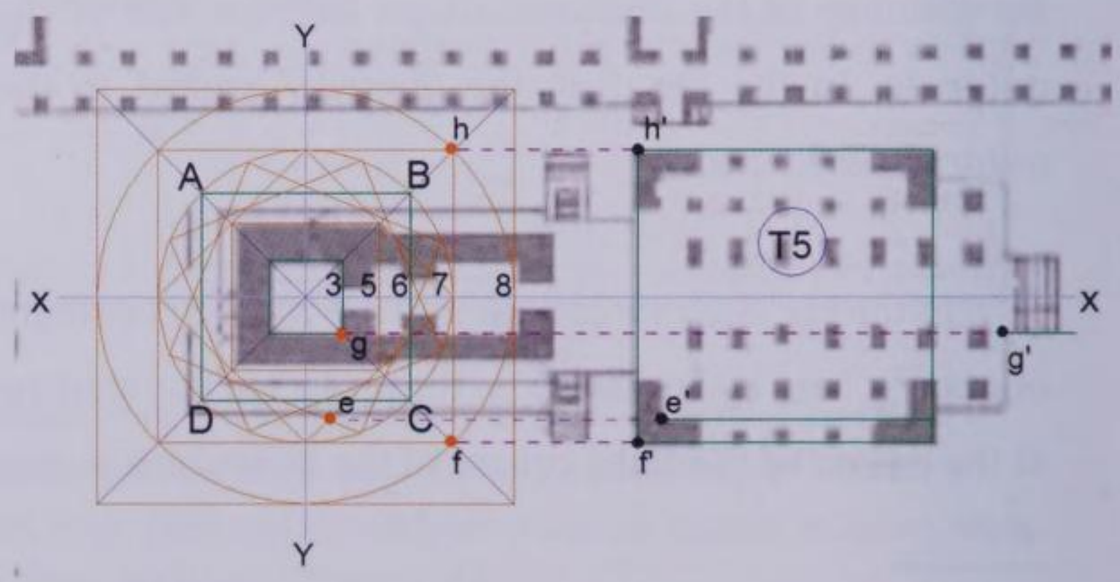
Figure 8.19 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The doorway leading to the *antarala* is defined

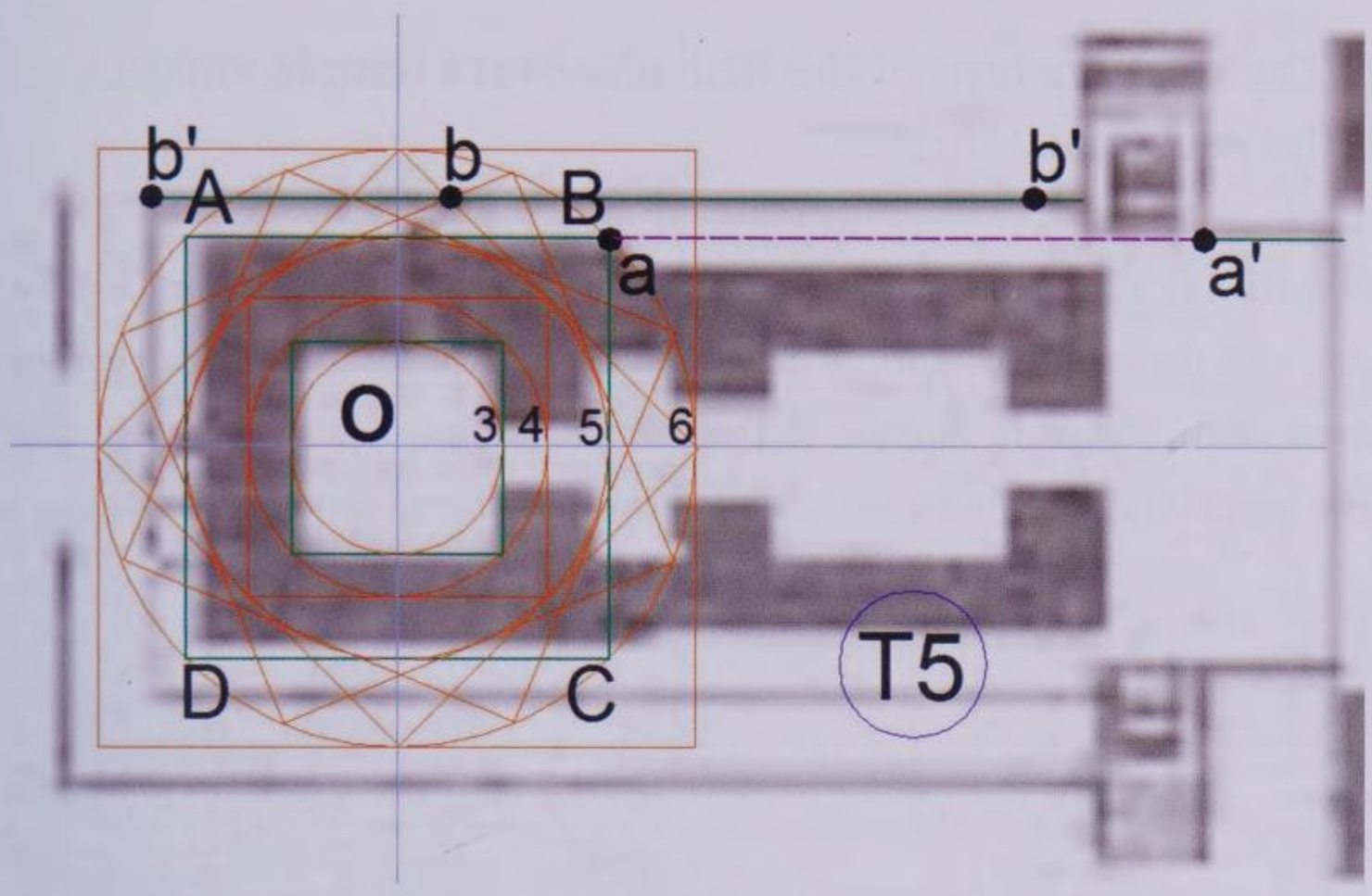
Figure 8.20 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The width of the flight of steps 'g' can be derived from the projected line starting at the corner of the third square of the SCS which is also the *garbhagriha* wall.

Figure 8.21 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The width of the doorway into the *vimana* is governed by the projections 'g-g'' and 'h-h''. Also note derivations from projection 'f-f''.



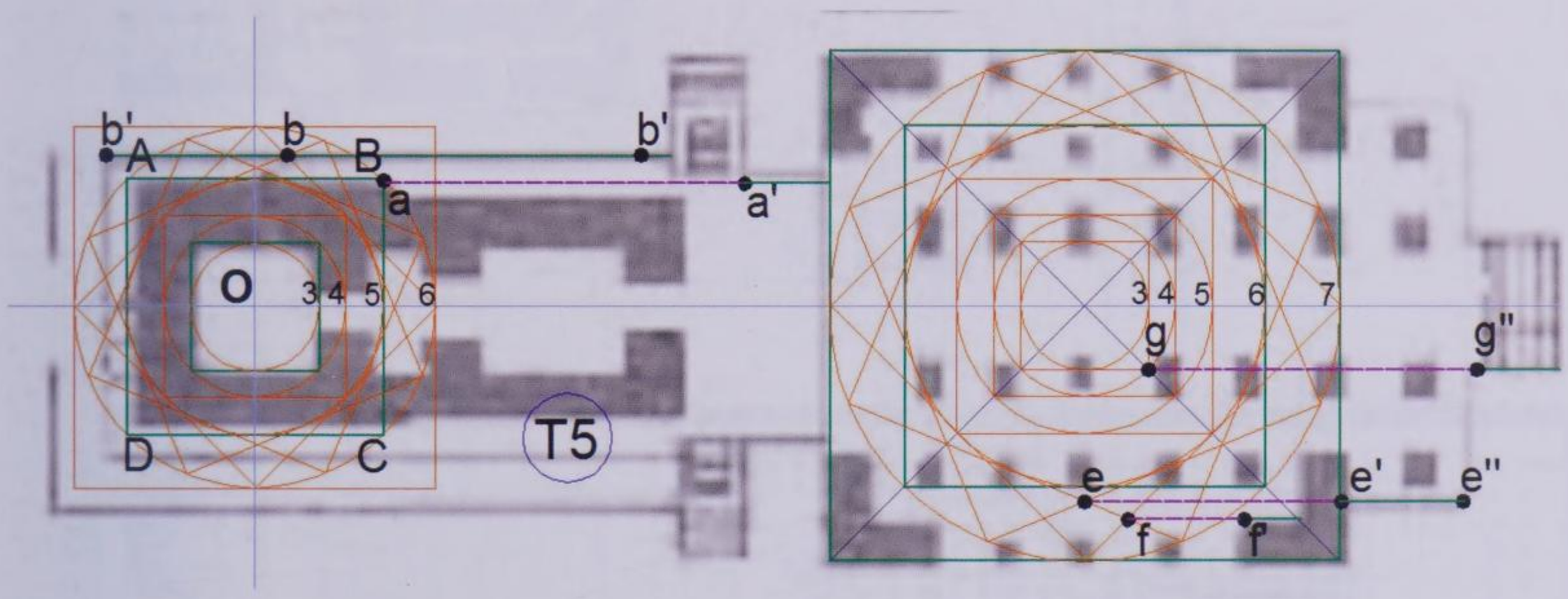






Top to bottom
Figure 8.22 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. I have shown that the marma 'b' will be giving us the location of the plinth of the *vimana*.

Bottom
Figure 8.23 Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The application of SCS and its geometrical dervations to the ardhamandapa.

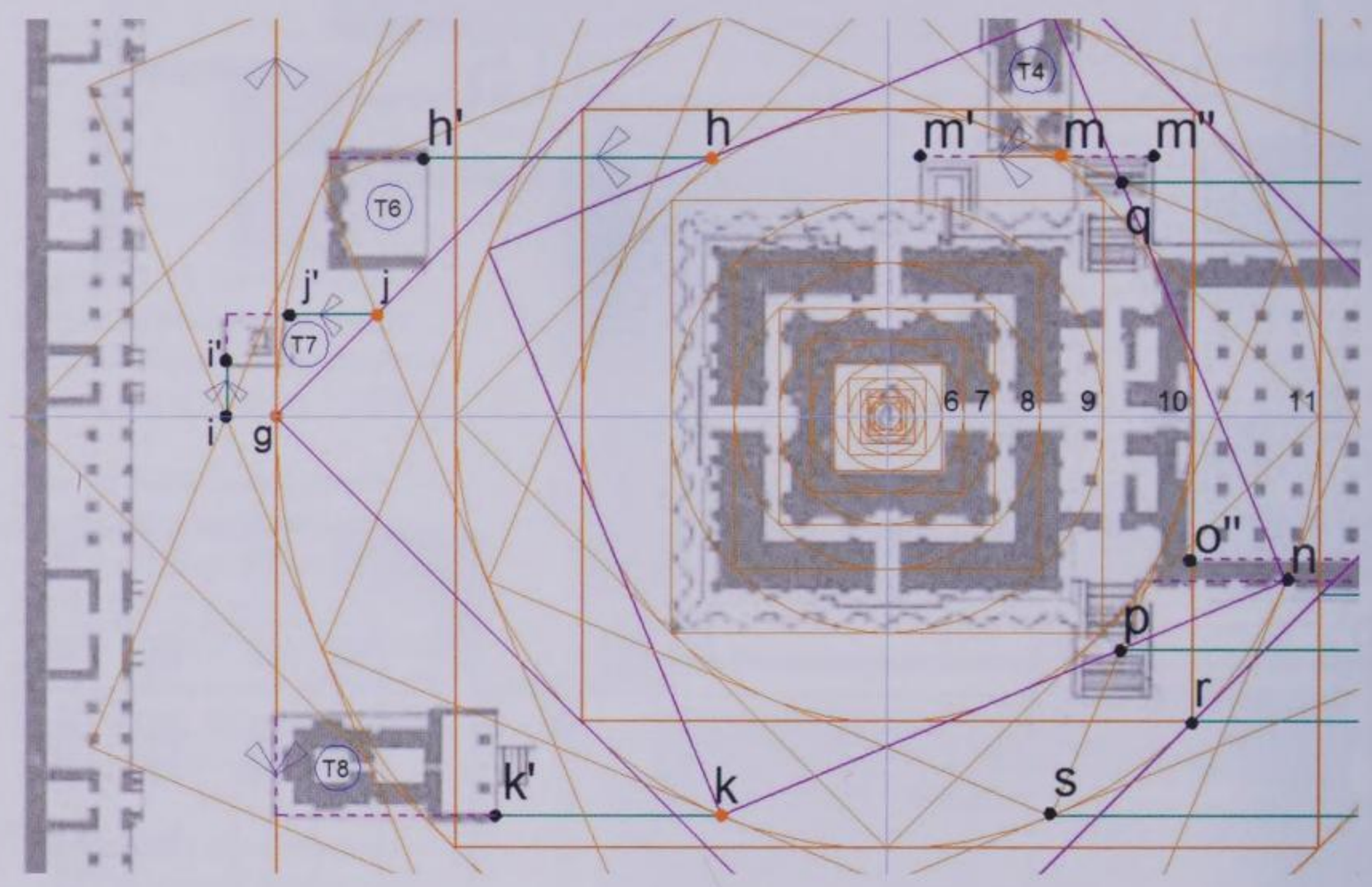


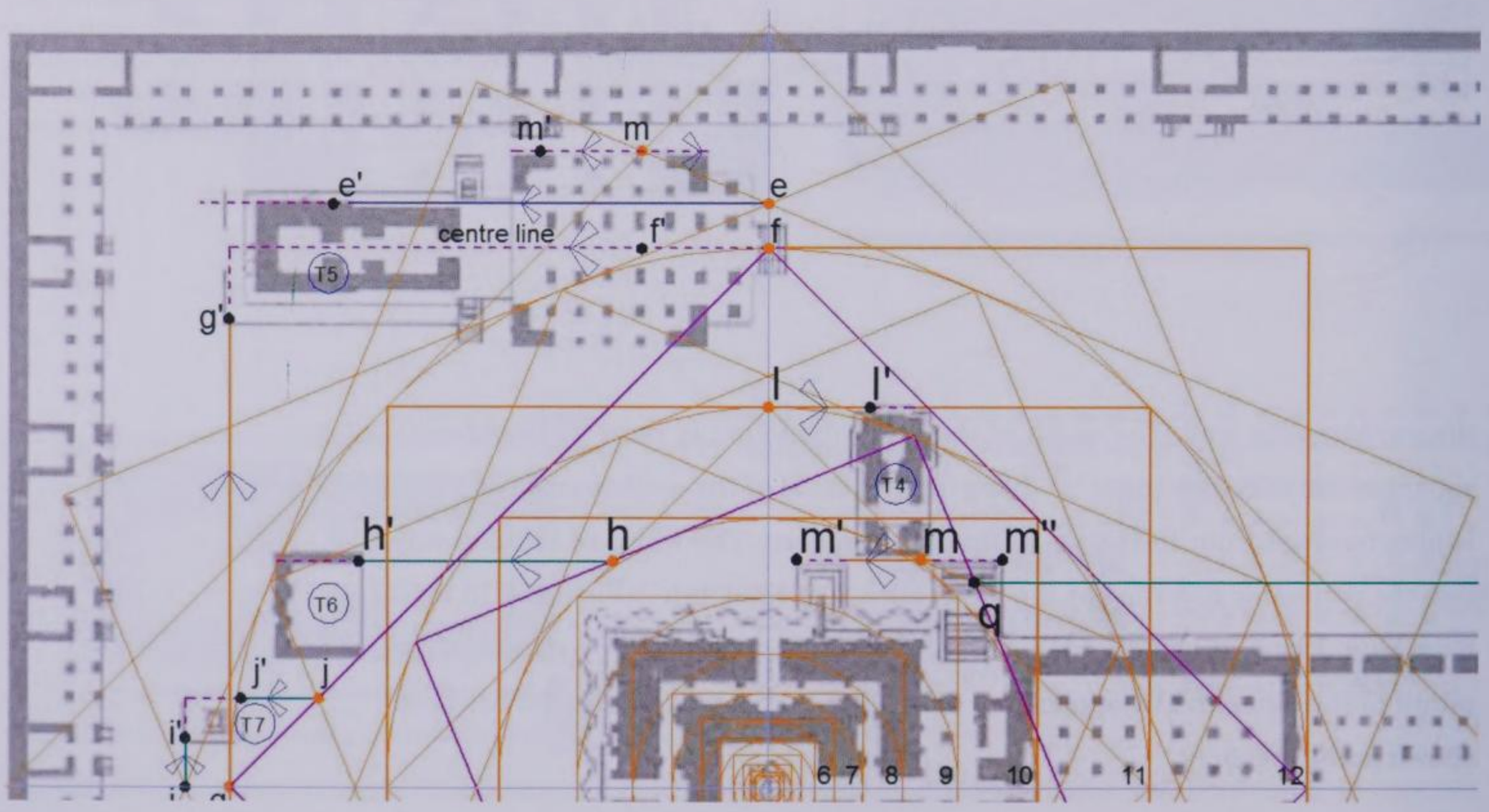
the *garbhagriha* wall. The width of the *ardhamandapa* is same as the seventh square of the SCS. The point 'e´' lying on the inside of the *ardhamandapa bhitti* is also received from the SCS's sixth rotated square. The width of the doorway into the *vimana* is governed by the projections 'g-g´' and 'h-h´' (Fig.8.21). In Figs. 8.22-8.23, I have shown that the *marma* 'b' will be giving us the location of the plinth of the *vimana*. The application of the SCS to the *ardhamandapa* has been shown in the Fig. 8.23.

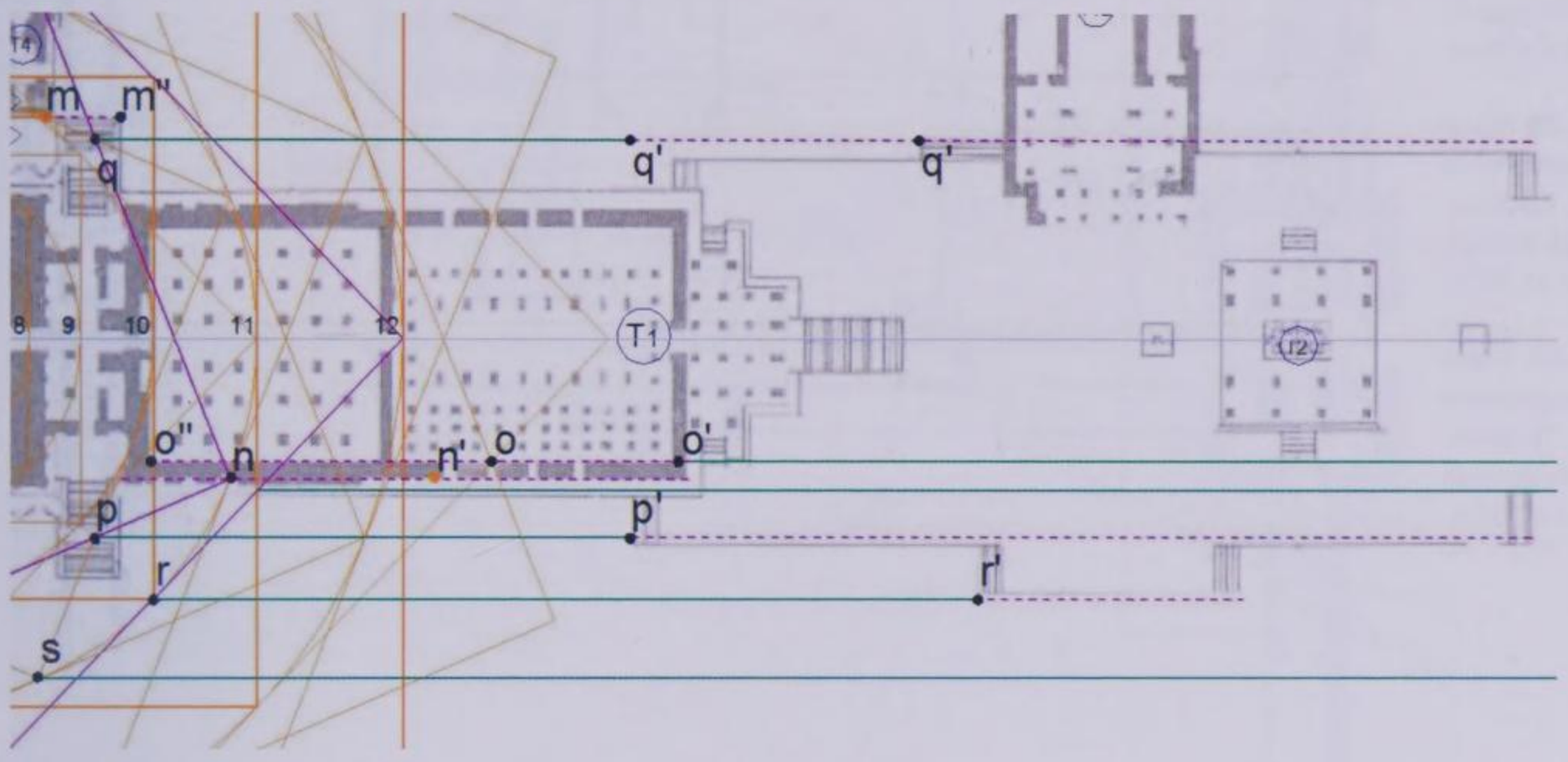
8.3 The relationships of the Brihadeshvara temple vimana, with the subsidiary shrines

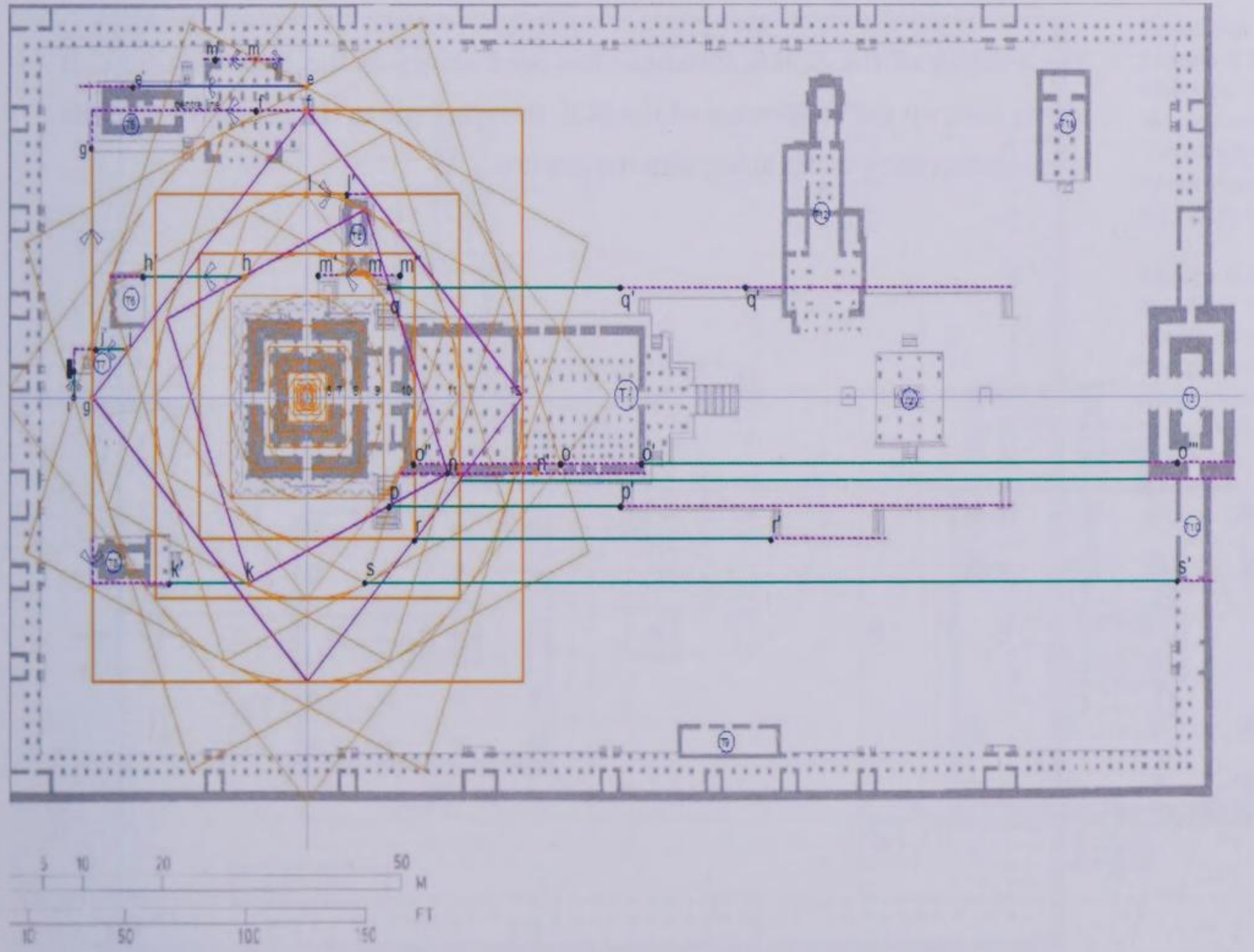
In the following Figs. 8.24-8.28, the relationships of the Brihadeshvara temple *vimana,* with the subsidiary shrines have been shown. The locations which earlier appeared oddly placed in relation to the main *vimana*, seem to me, after this analysis logical and confirming to the temple layout's overall complex nature.

Top to bottom
Figure 8.24 & 8.25
Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationships of the Brihadeshvara temple *vimana*, with the subsidiary shrines are shown.









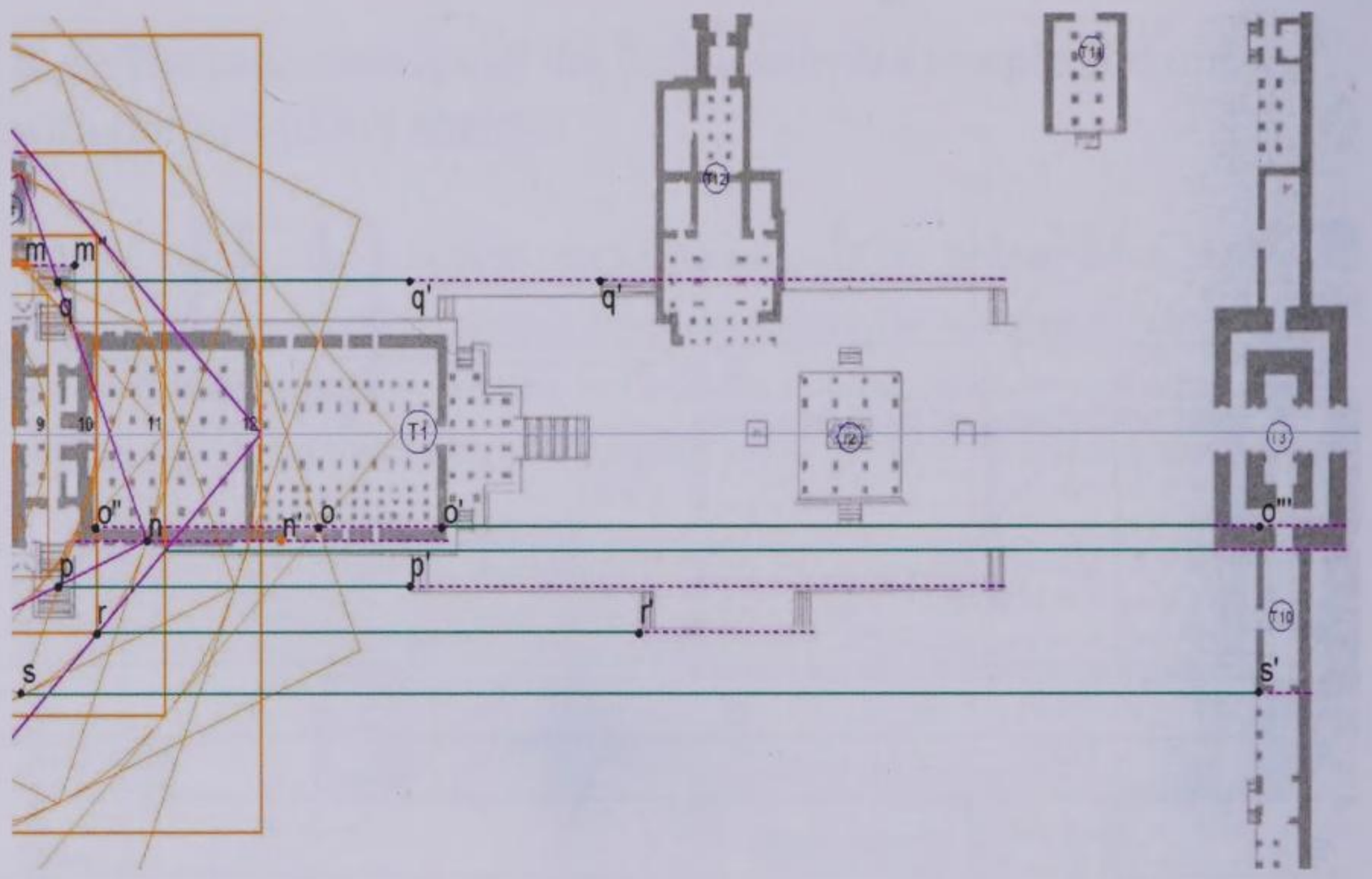
Top to Bottom Figure 8.26 & 8.27 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationships of the Brihadeshvara temple *vimana*, with the subsidiary shrines are shown.

Anti clockwise from Top

Figure 8.28 Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationships of the Brihadeshvara temple *vimana*, with the front *gopura* are shown.

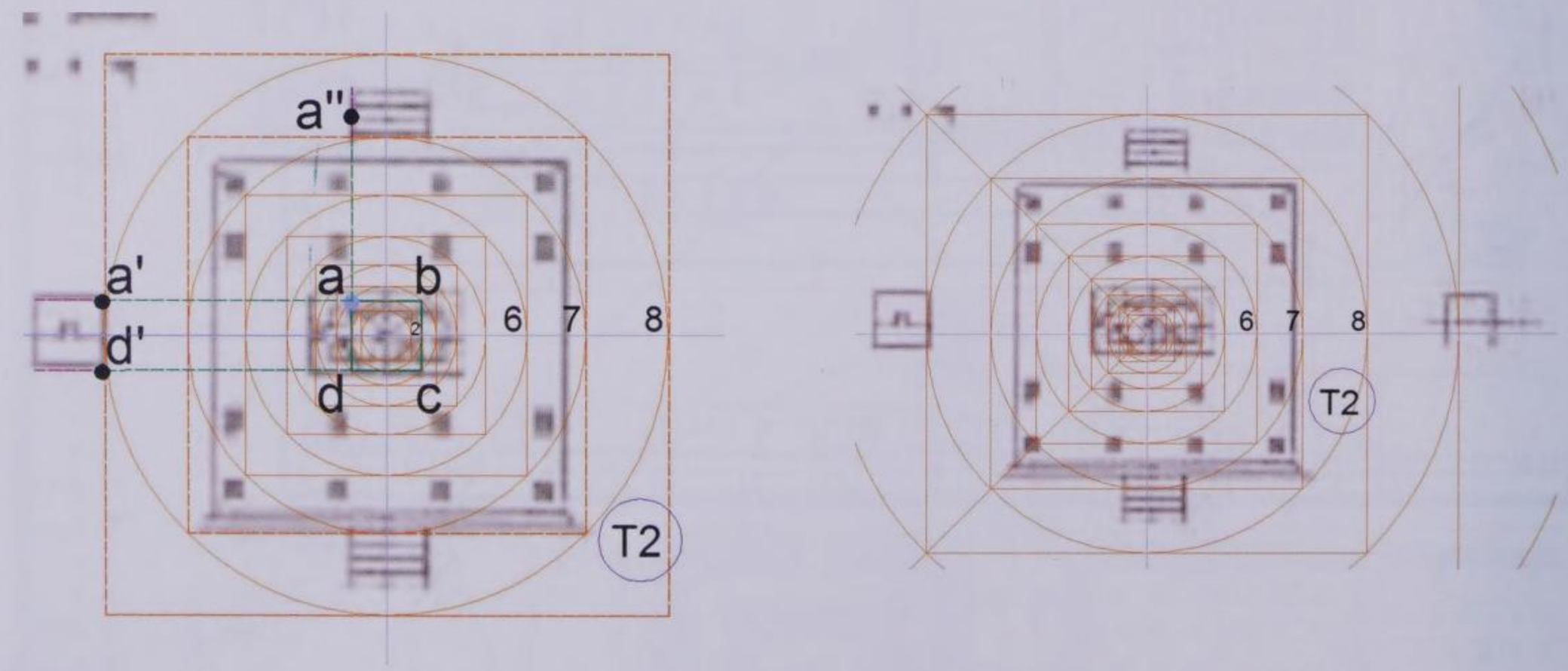
Figure 8.29 Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. Geometrical Analysis through application of SCS.

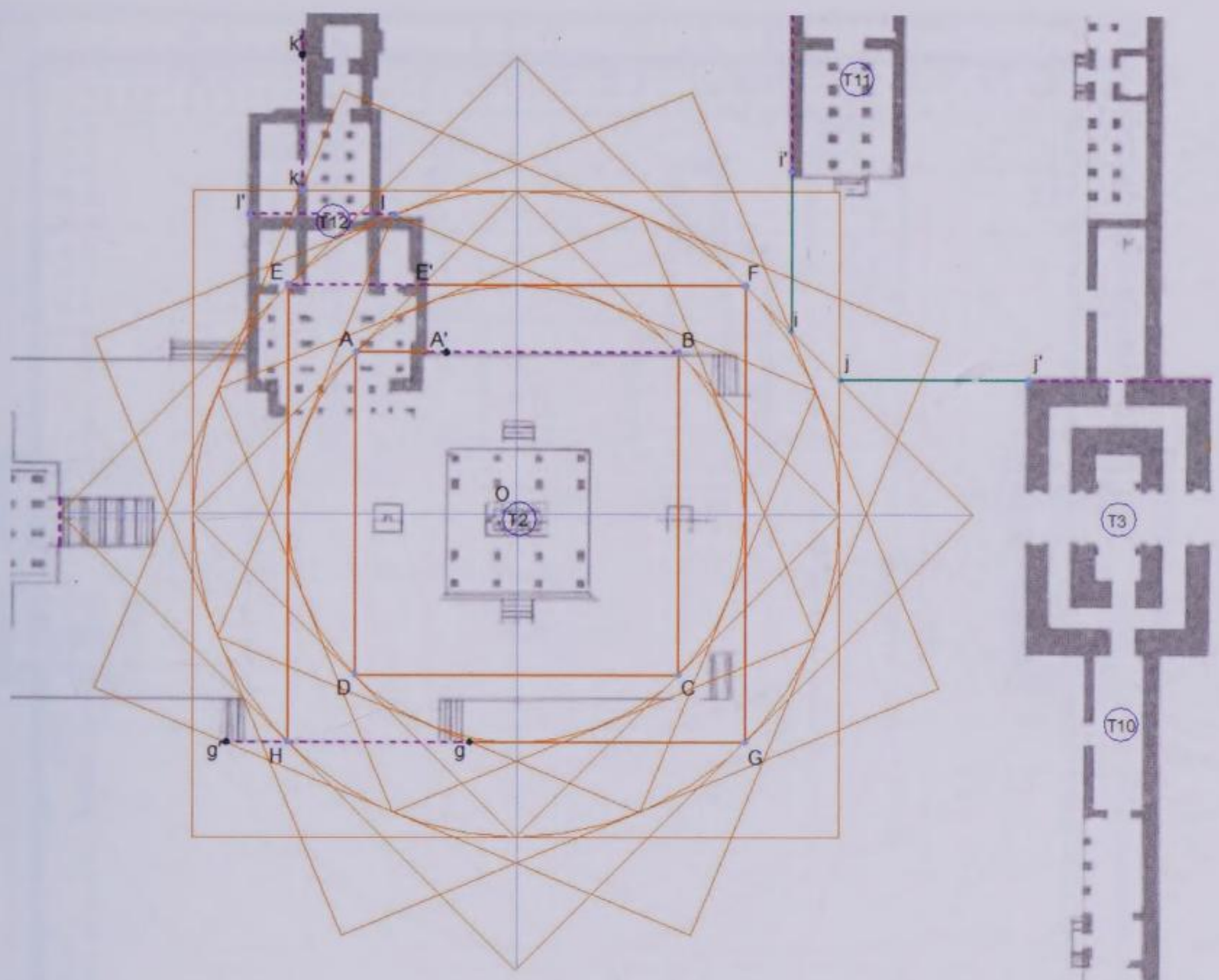
Figure 8.30 Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. Geometrical Analysis through application of SCS.

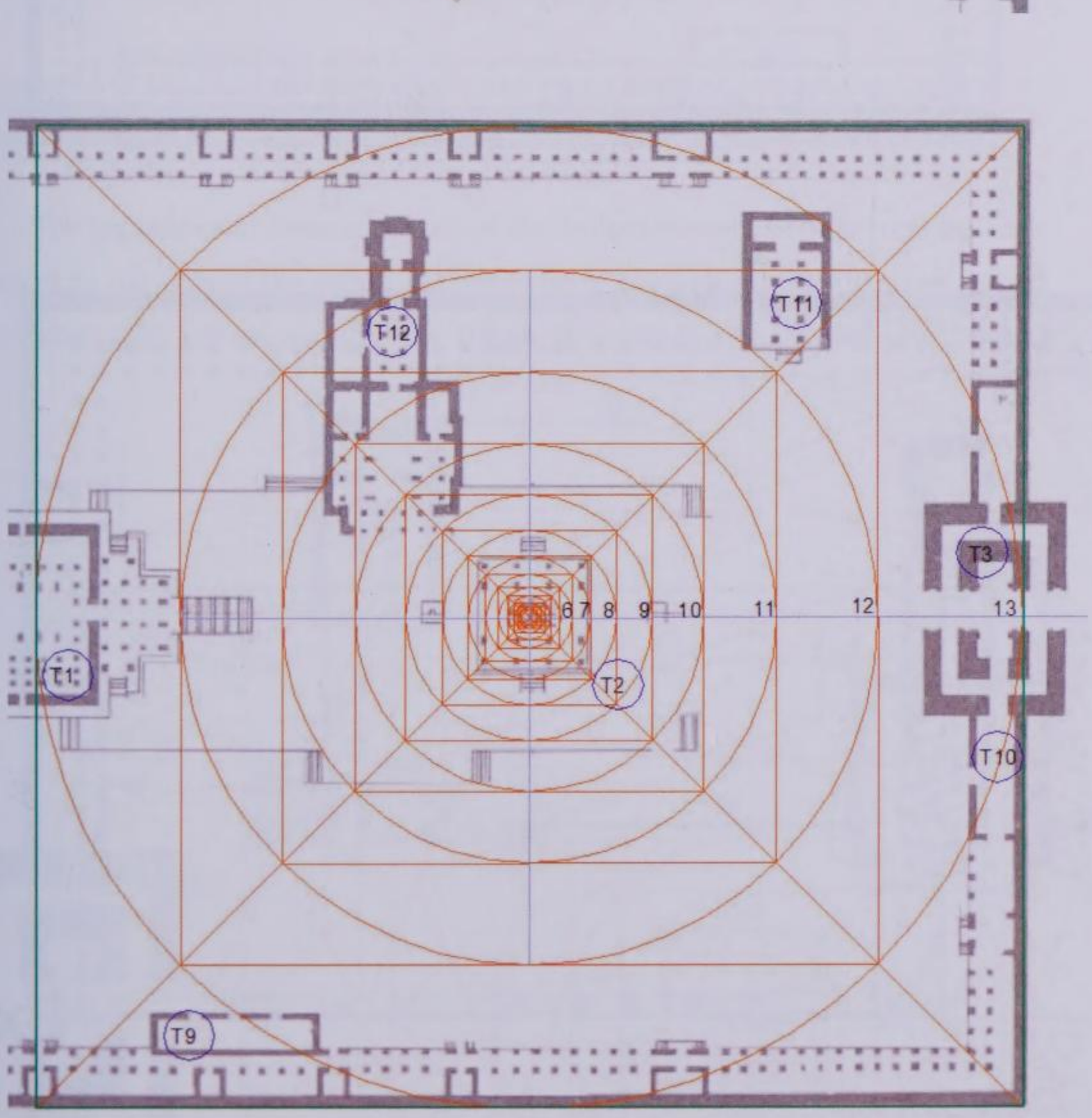


8.4 Analysis of the Nandi Mandapa

The analysis of the *Nandi Mandapa* has been shown in the Figs. 8.29-8.34. It shows that, on the application of the SCS, there is logic to the geometry of all its surrounding sub shrines along with the *gopura*.







From top to bottom
Figure 8.31 Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.

Figure 8.32 Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.

Top to bottom
Figure 8.33 Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.

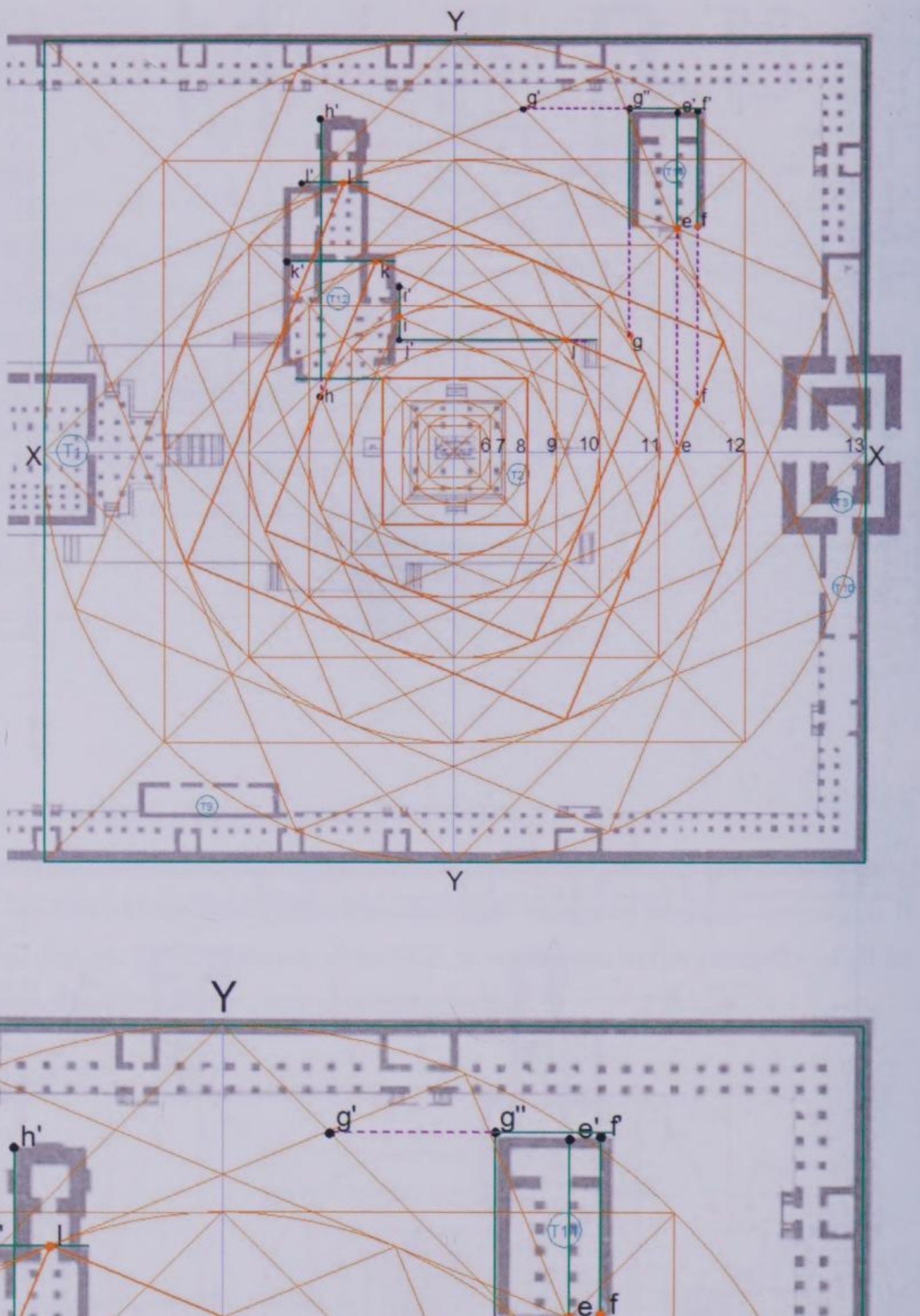
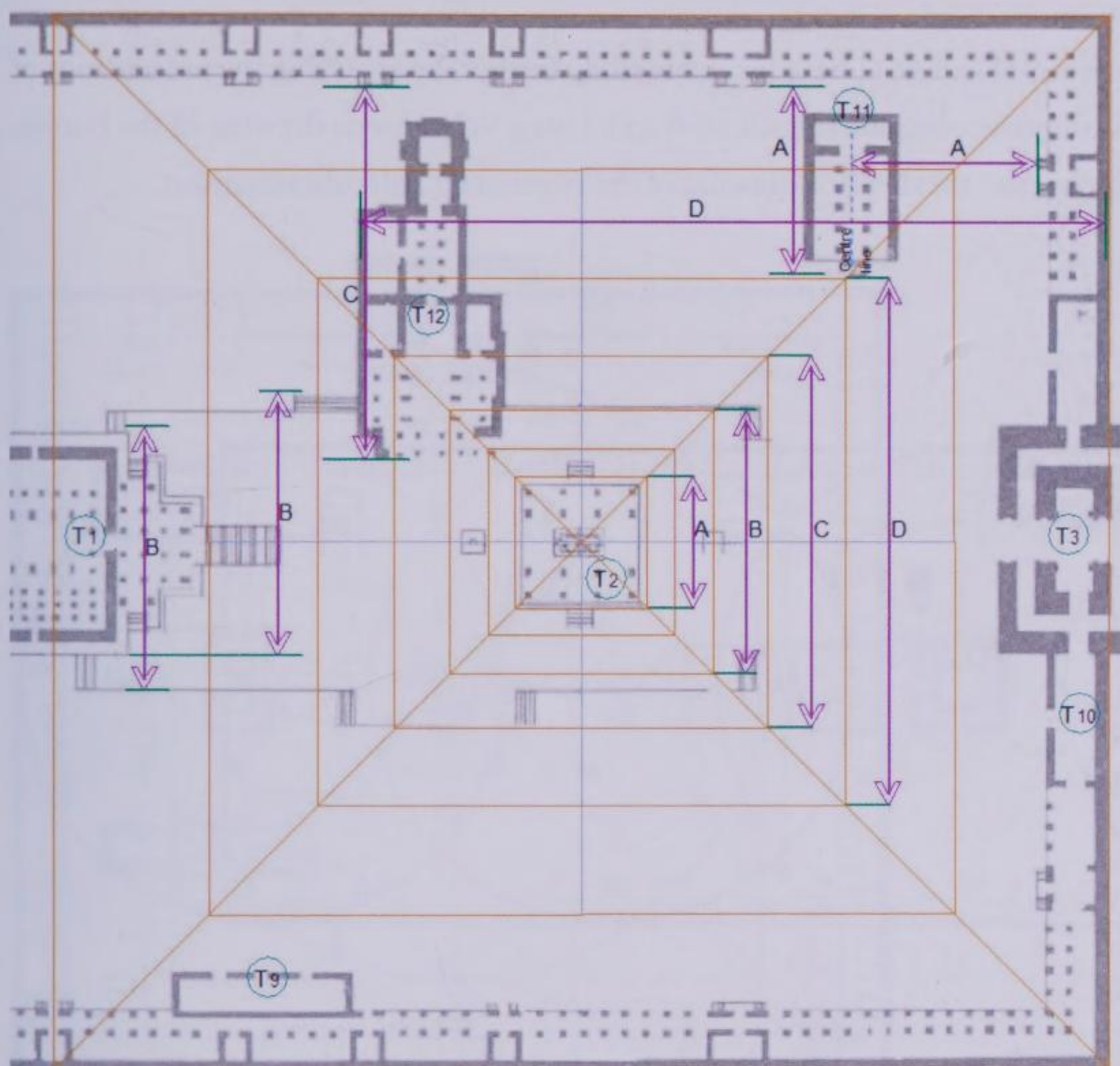


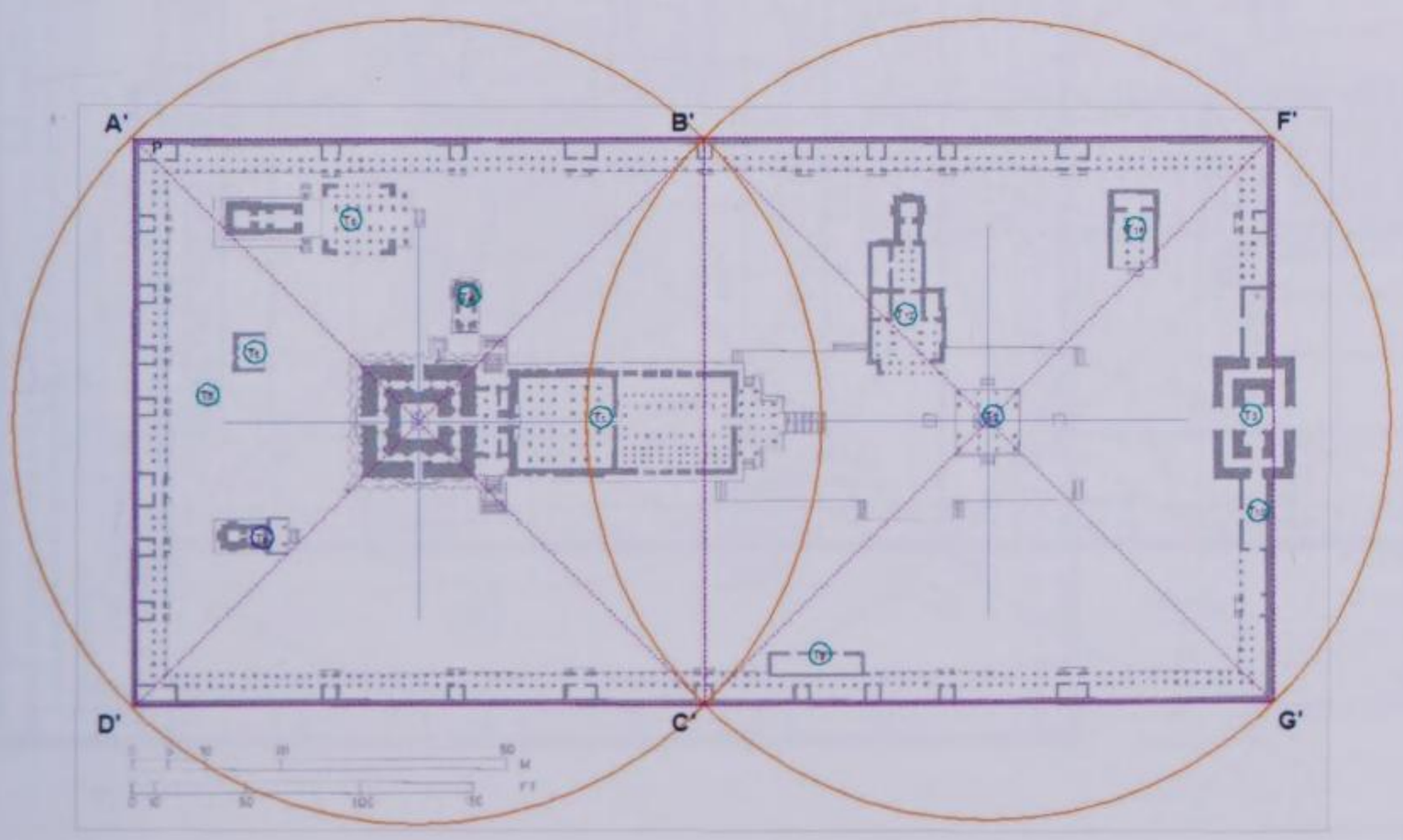
Figure 8.34 Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.



From top to bottom
Figure 8.35 Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The study of the proportional relationship between main shrine, *Nandi mandapa*, other subsidiary shrines and the peripheral wall.

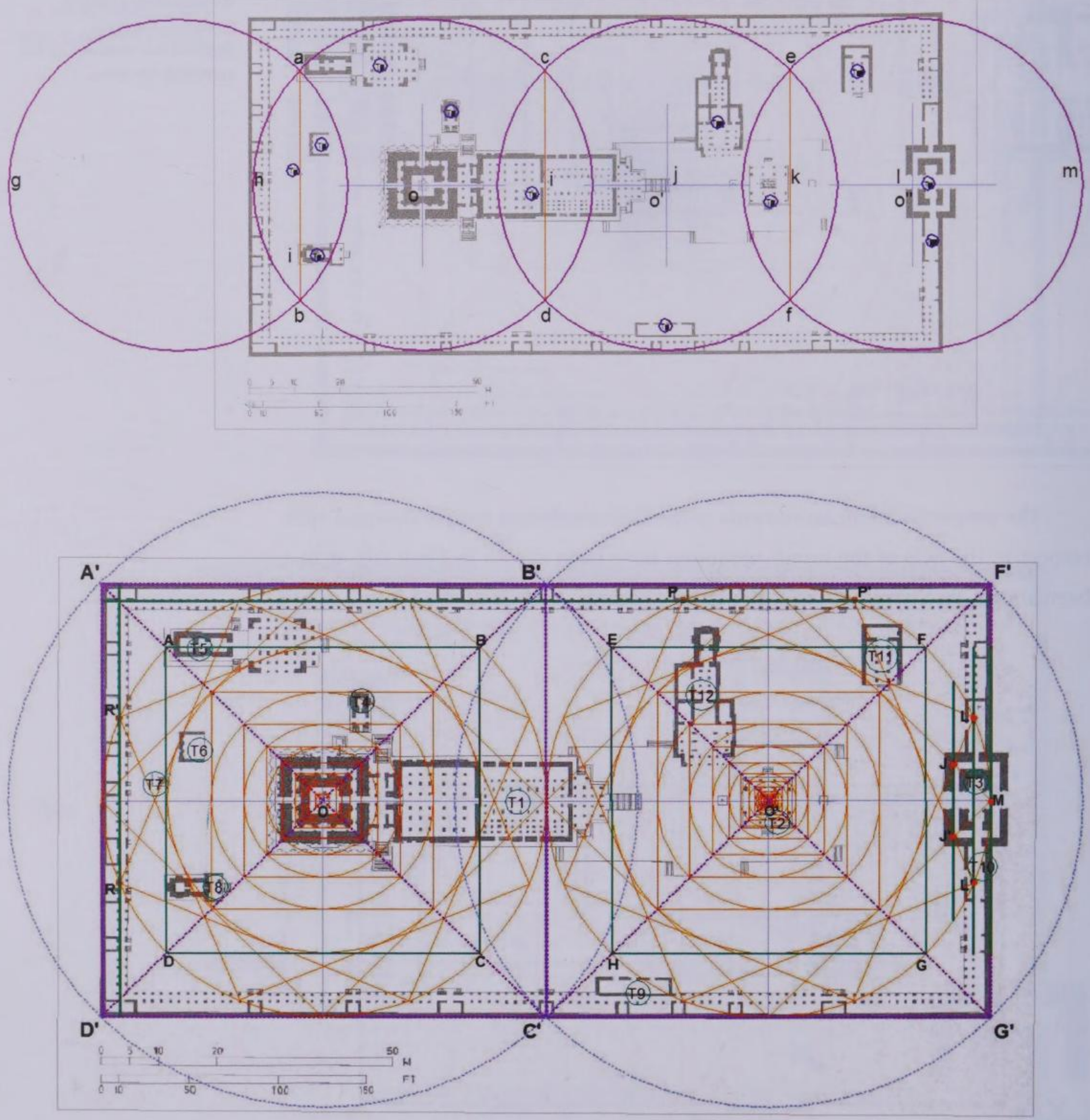
Figure 8.36
Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

The proportional measurements of the Brihadeshwara temple complex with respect to the SCS of the *nandi mandapa* have been shown in Fig.2.110. It had been shown by Volwahsen, that the temple complex can be divided into 2 equal



Top to Bottom
Figure 8.37
Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex

squares.[13] (Fig.8.36) I have taken his study further, by analysing the proportions of the complete complex (Figs.8.36-8.43). Using Volwahsens drawing of the temple complex and the detailed drawing of the *vimana* by Balasubramanyam.



[13] Andreas Volwahsen, *Living Architecture; Indian* (New York, Grosset & Dunlap, 1969) p.87

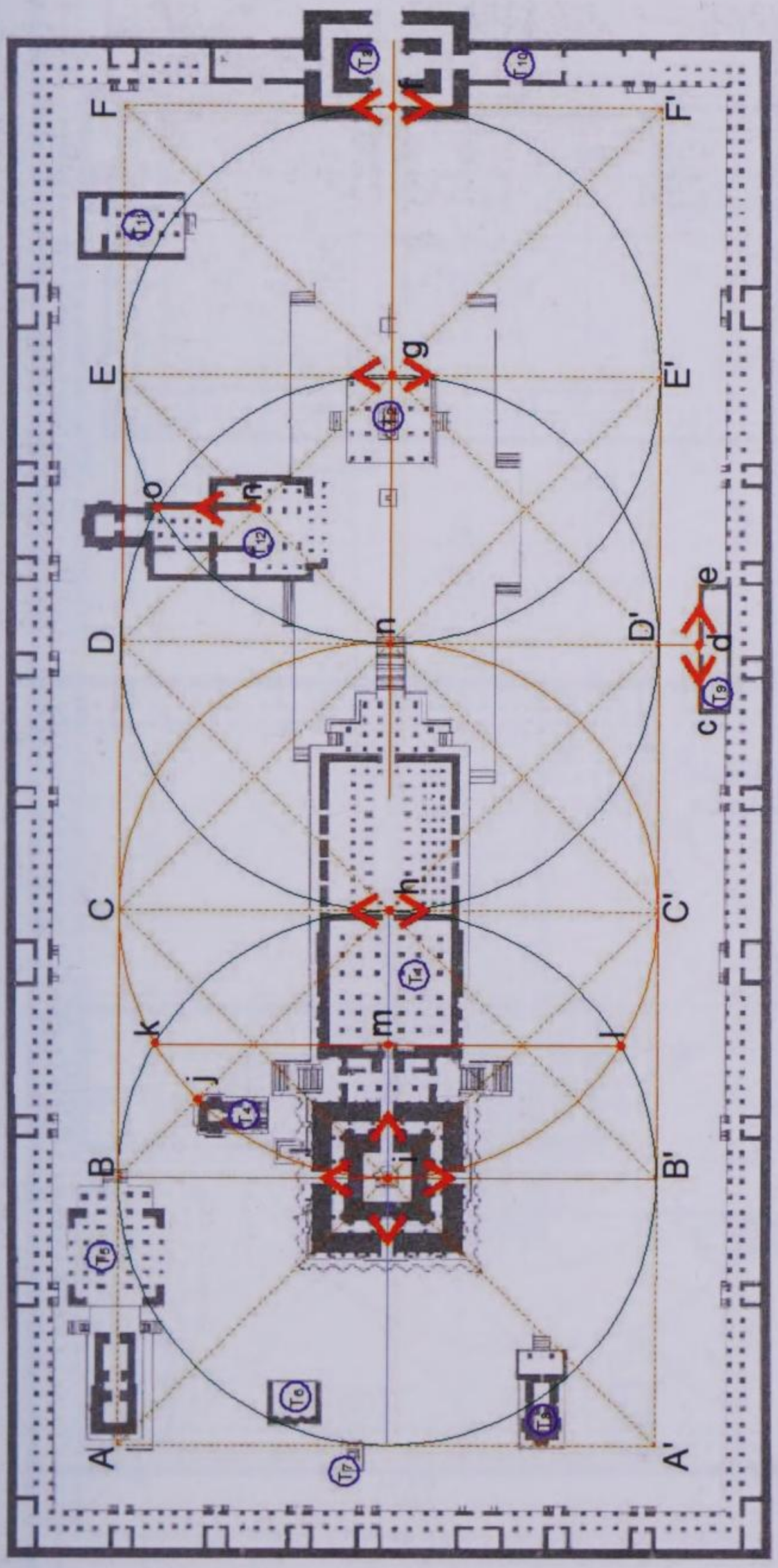
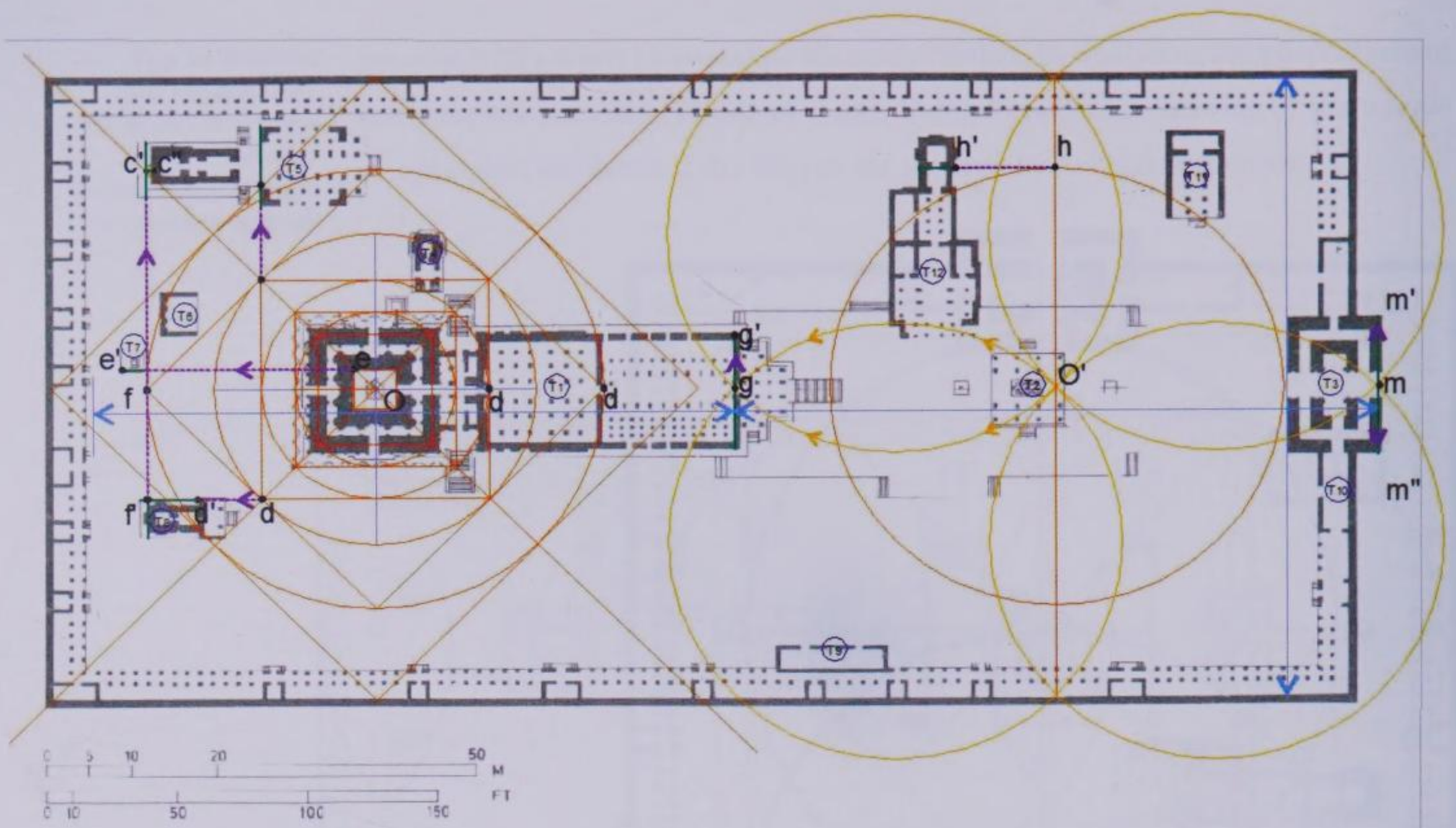


Figure 8.38 Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.



Top to Bottom

Figure 8.39 Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex

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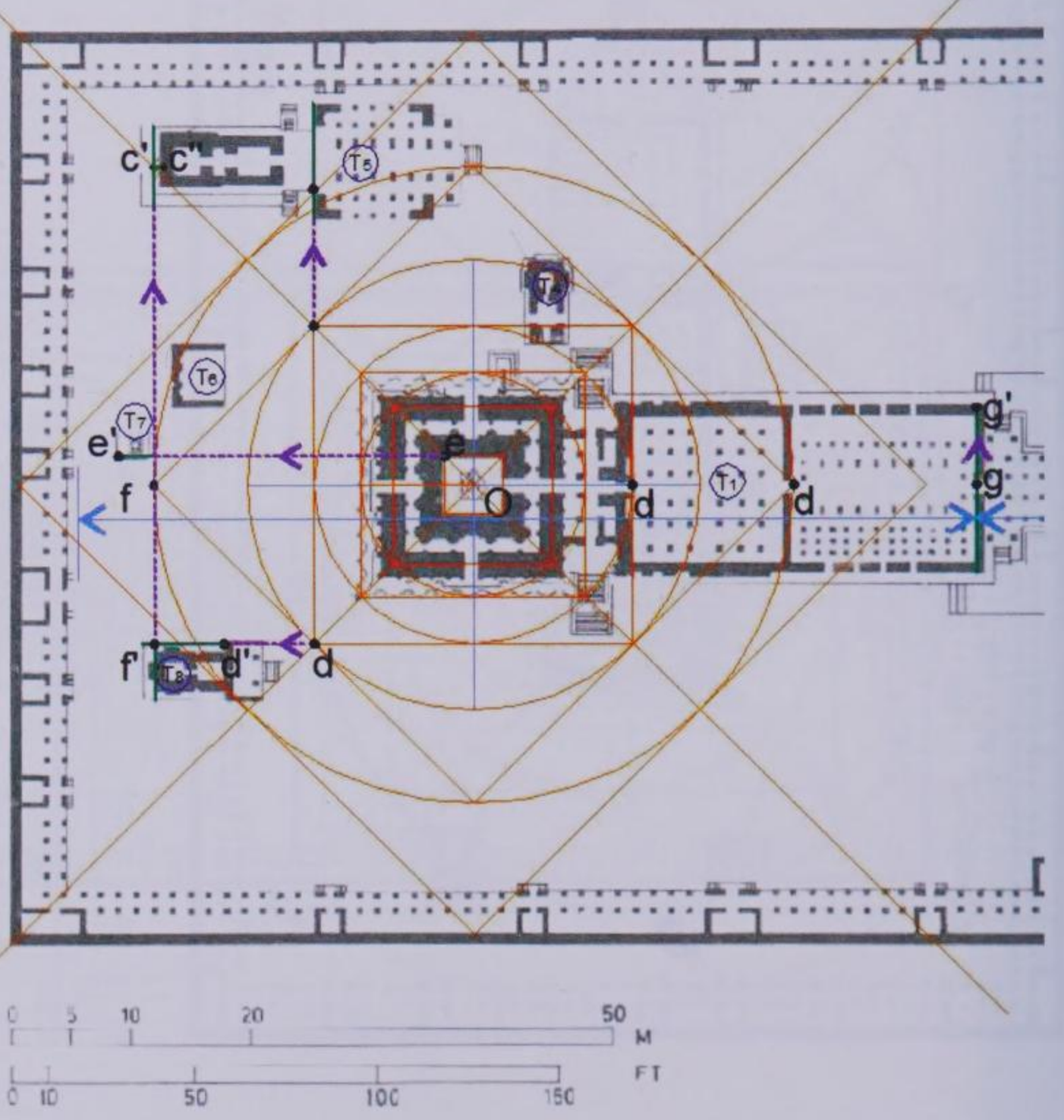
Figure 8.40 Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.



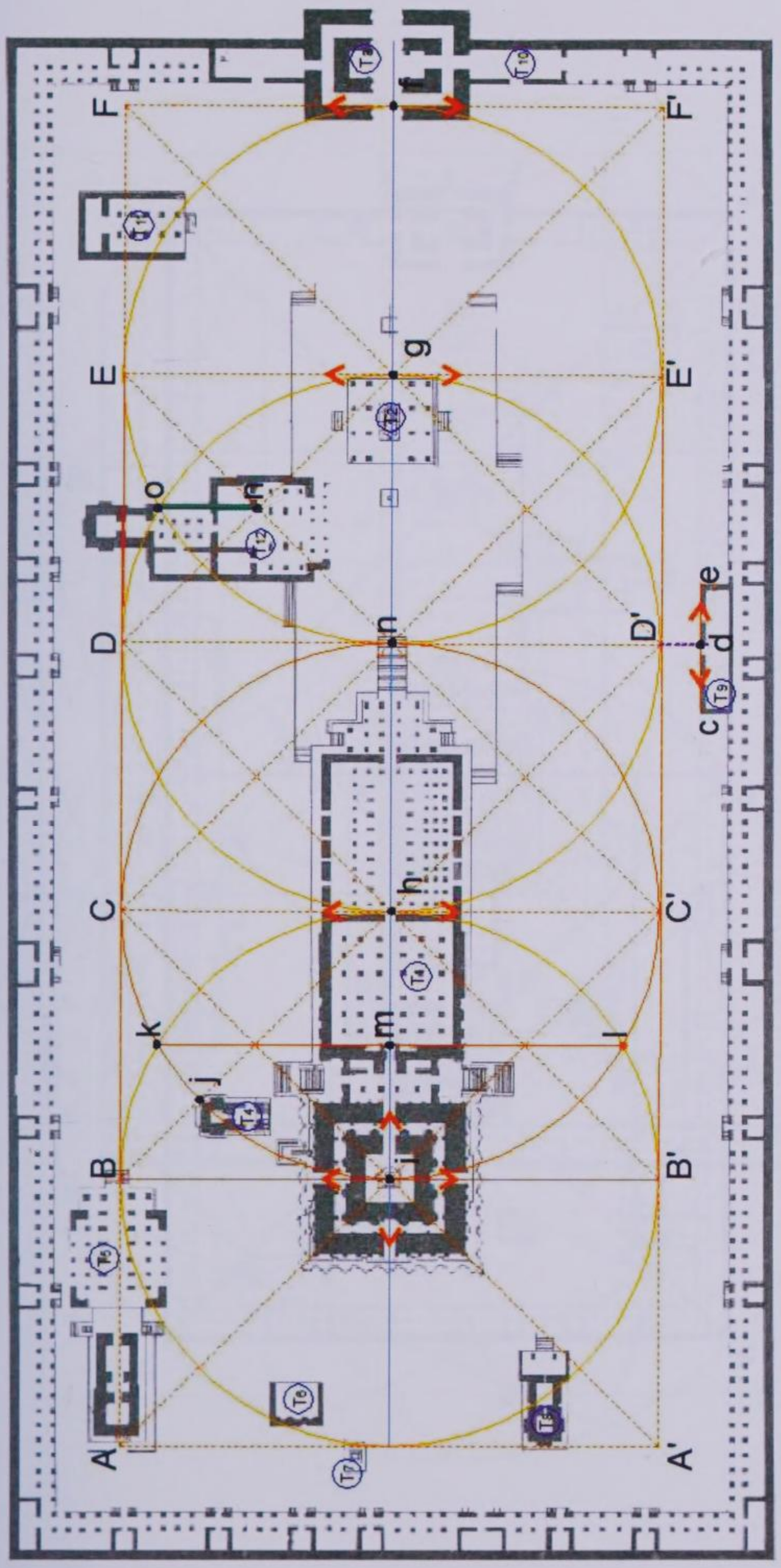


Figure 8.41
Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

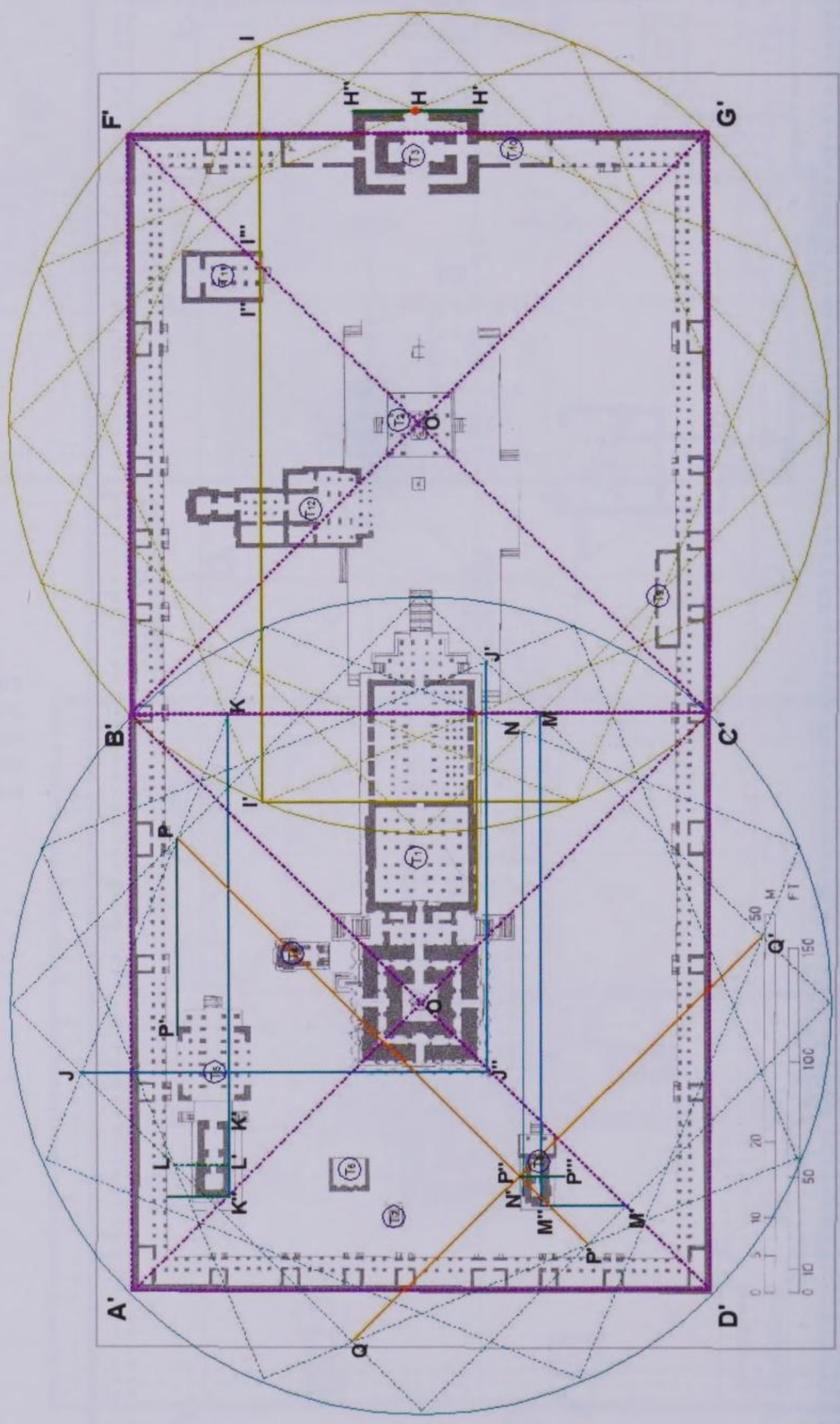


Figure 8.42 Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

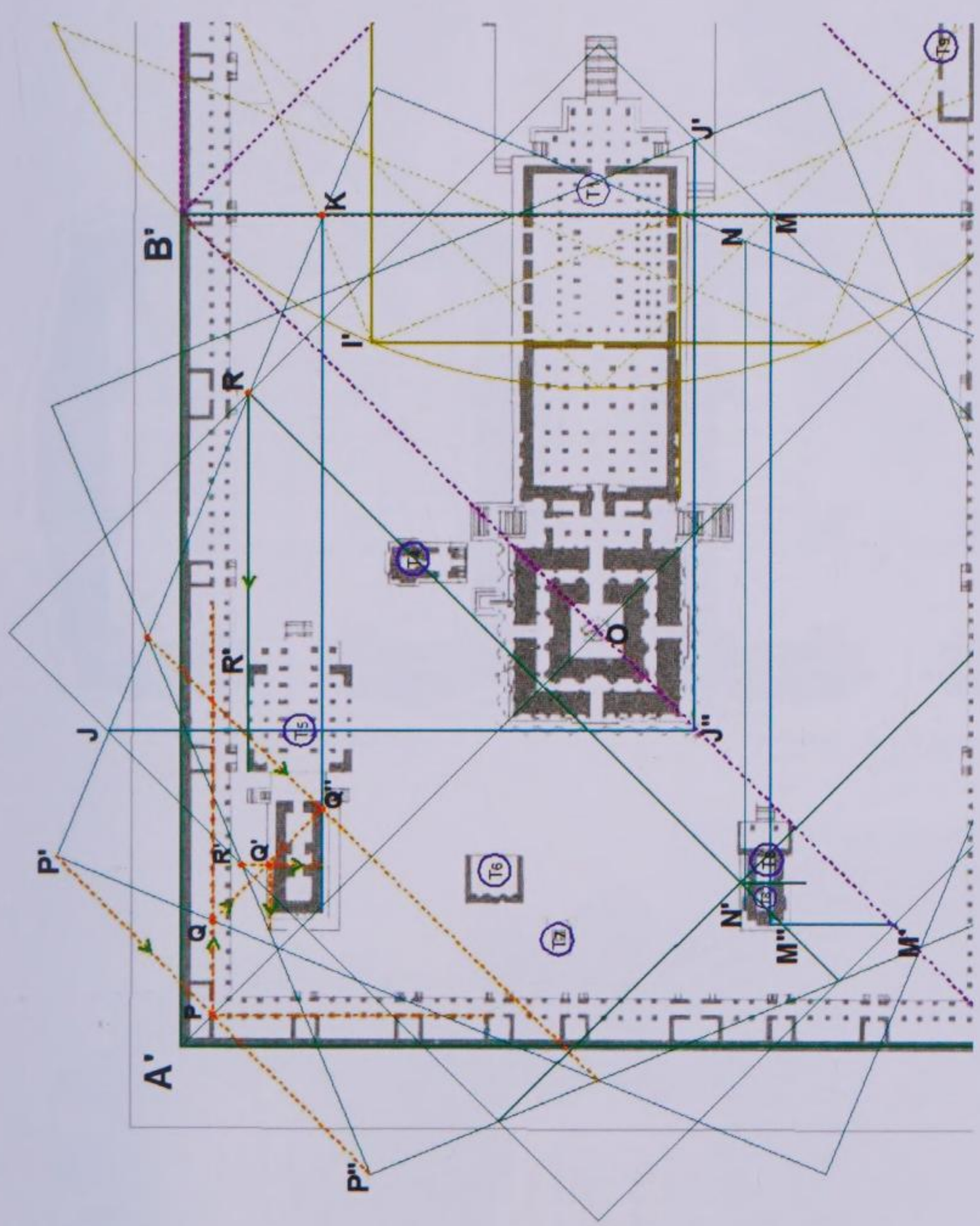
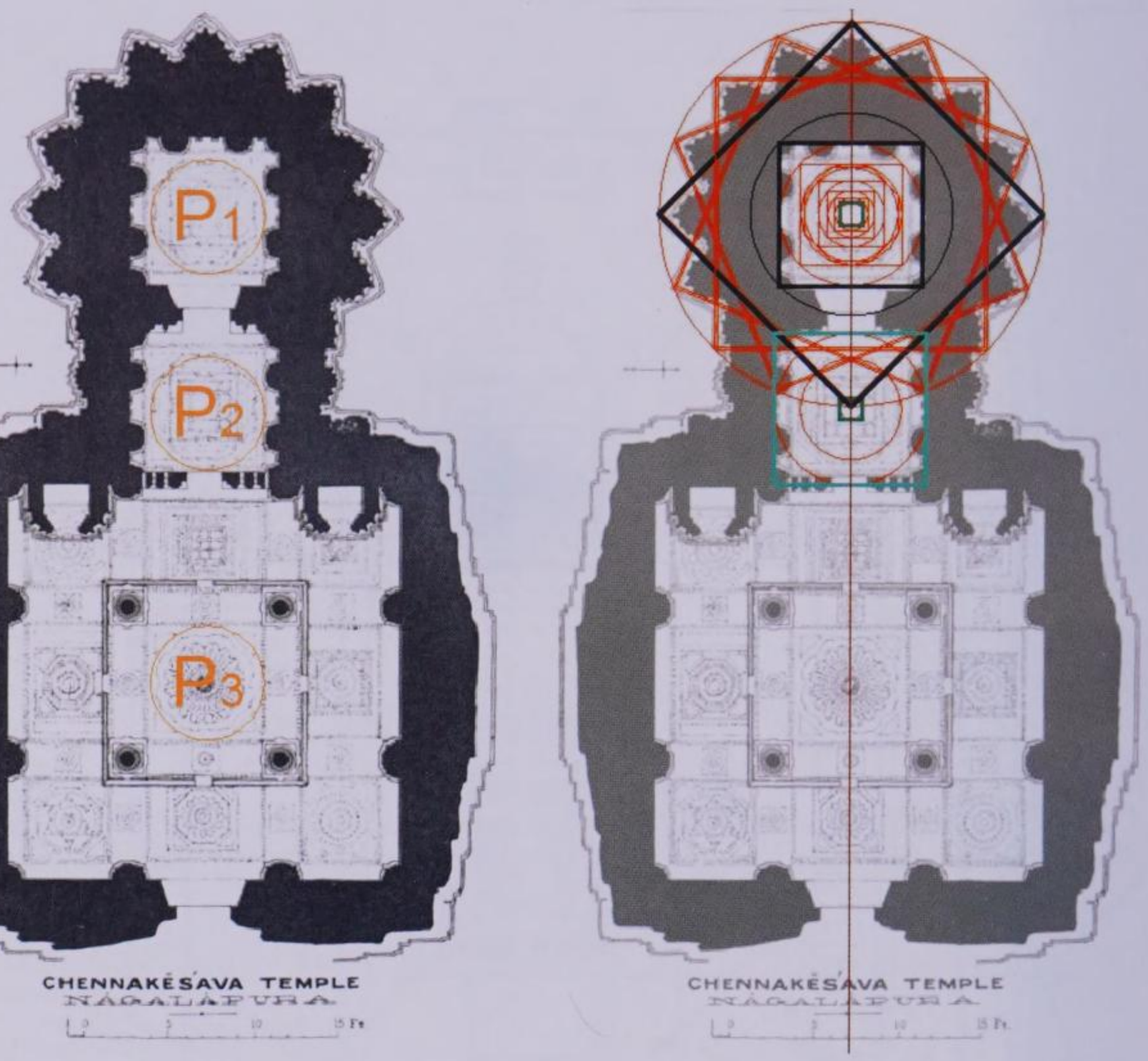
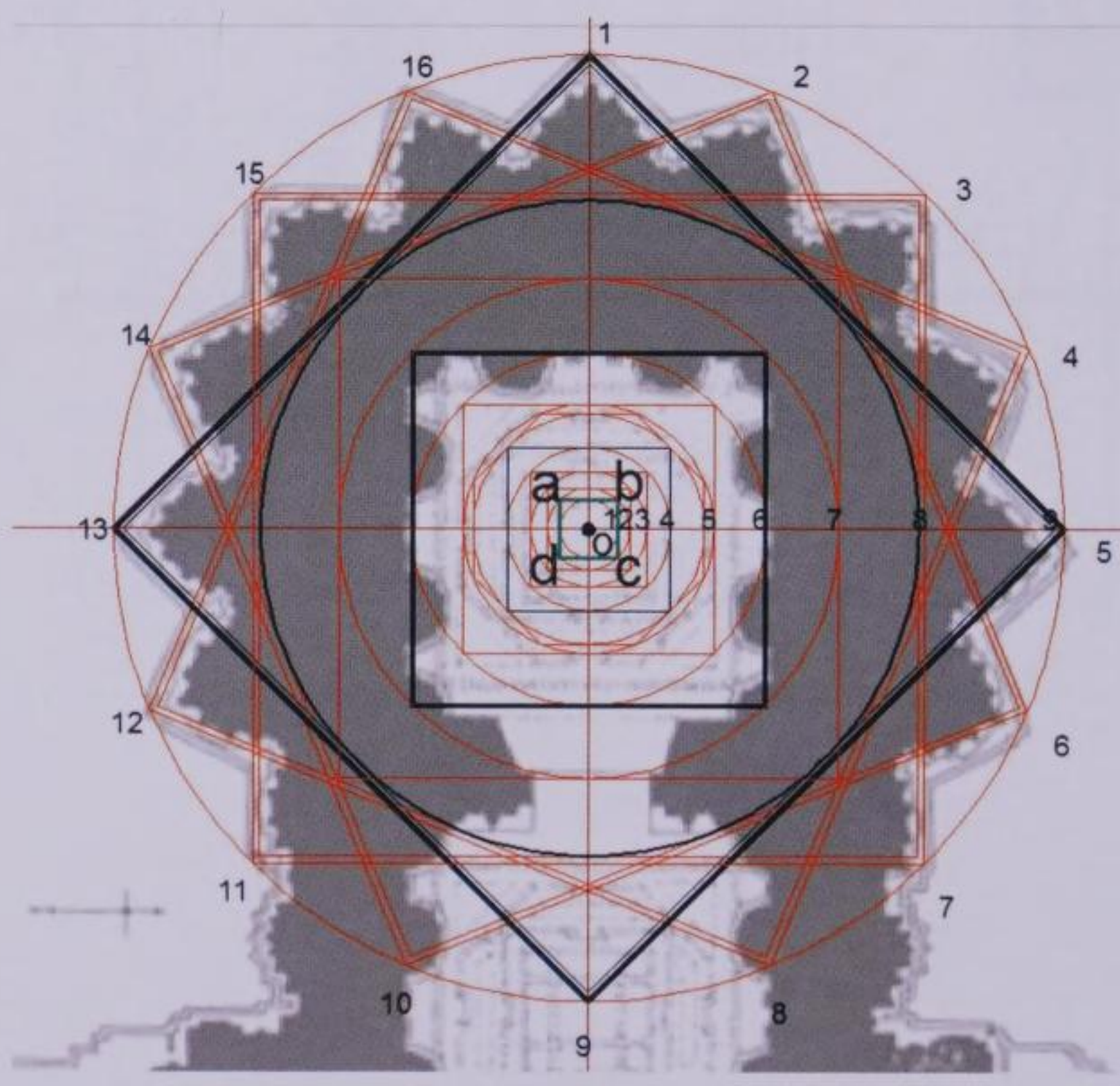
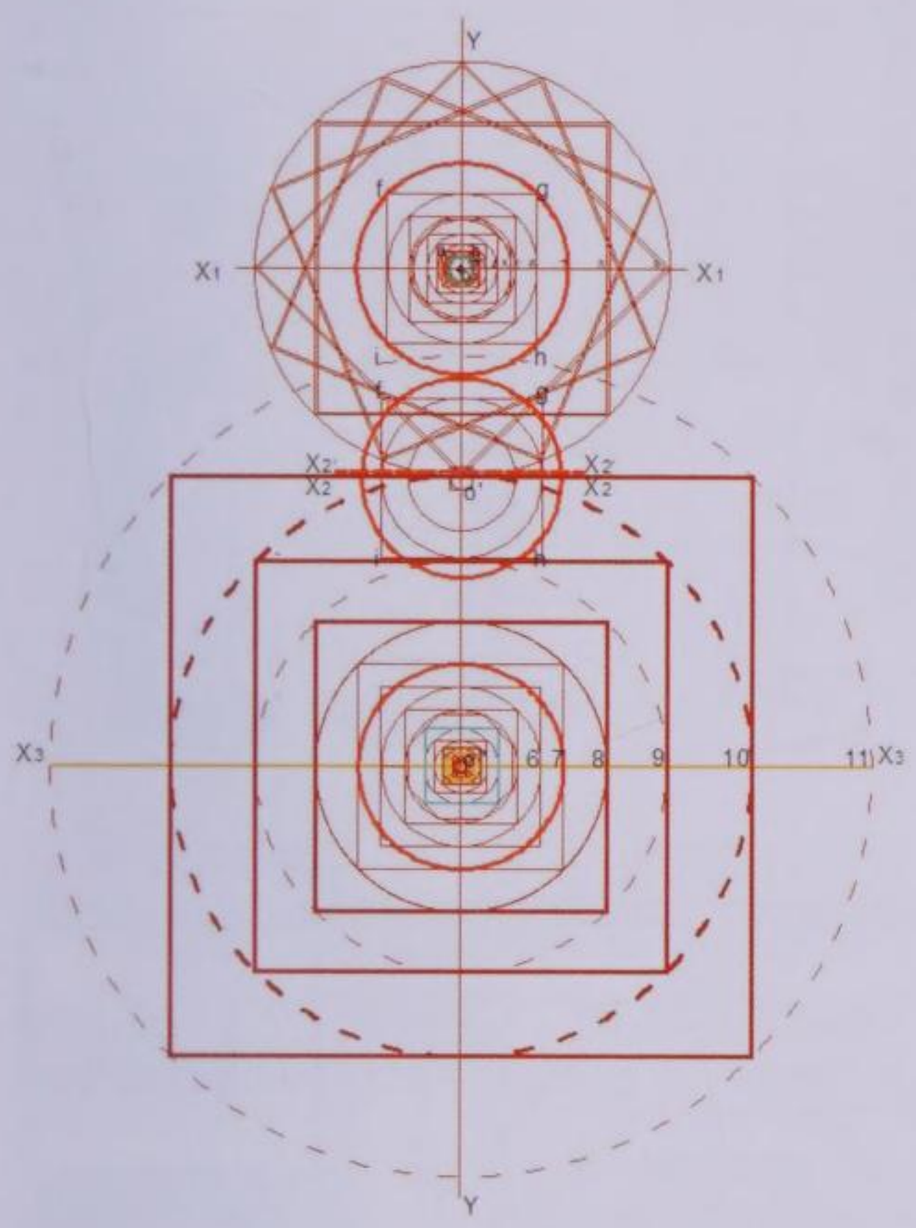


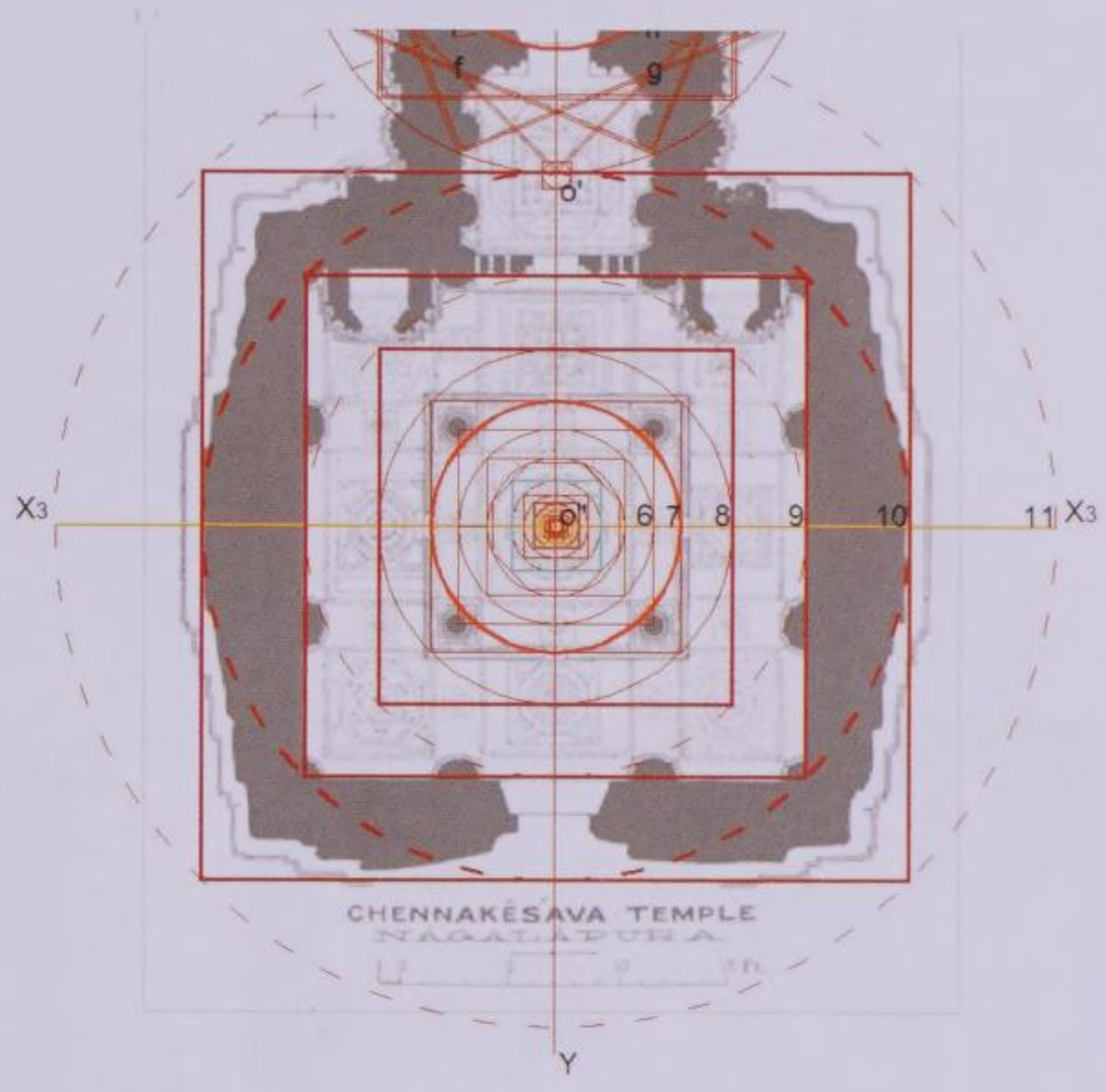
Figure 8.43 Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

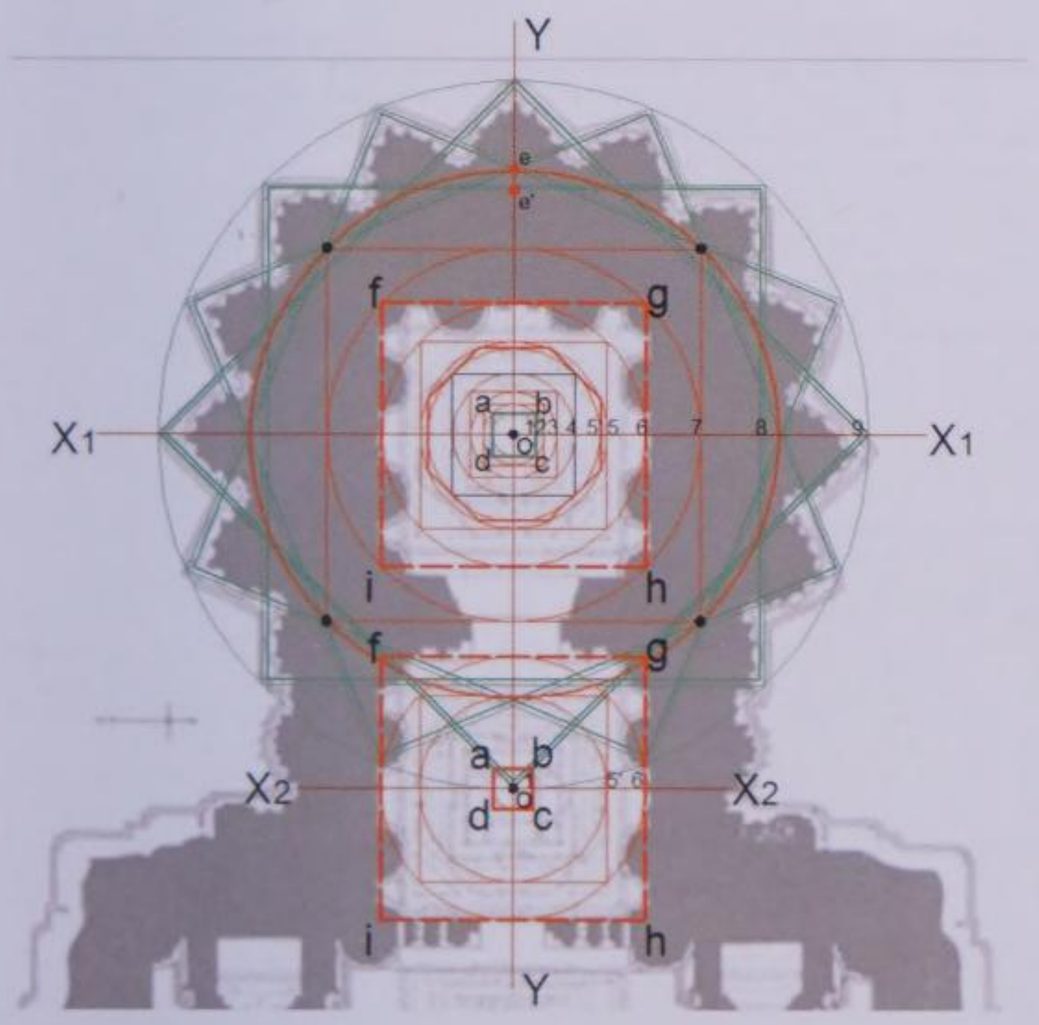
9.1 Pictorial Analysis of Chennakeshva temple, Nagalpura, Tumkur District, Karnataka, ca. A.D. 1200



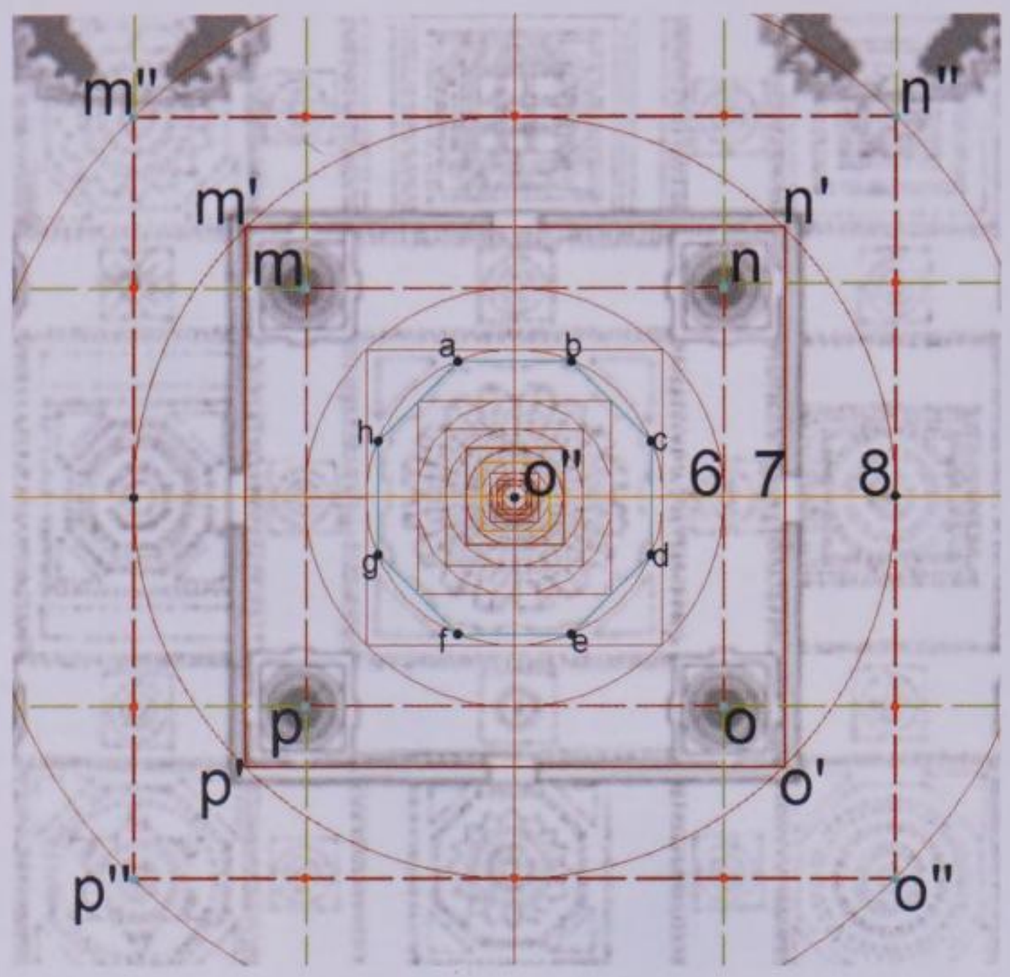


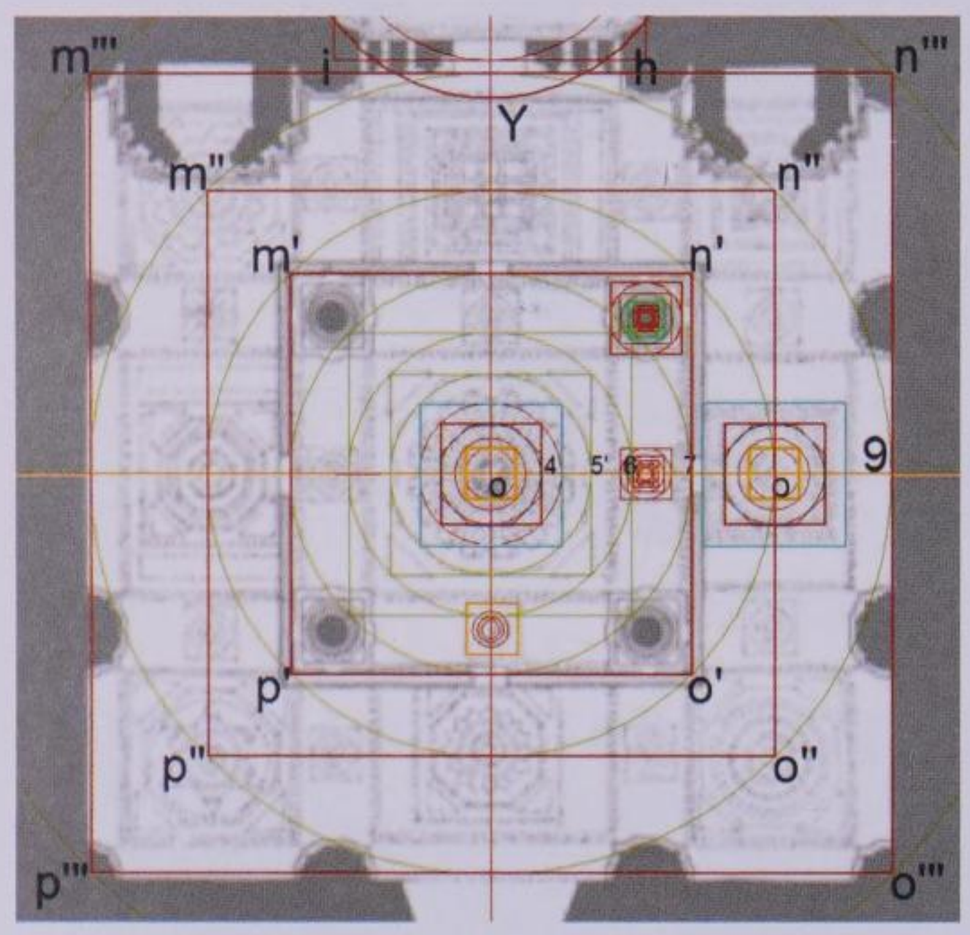


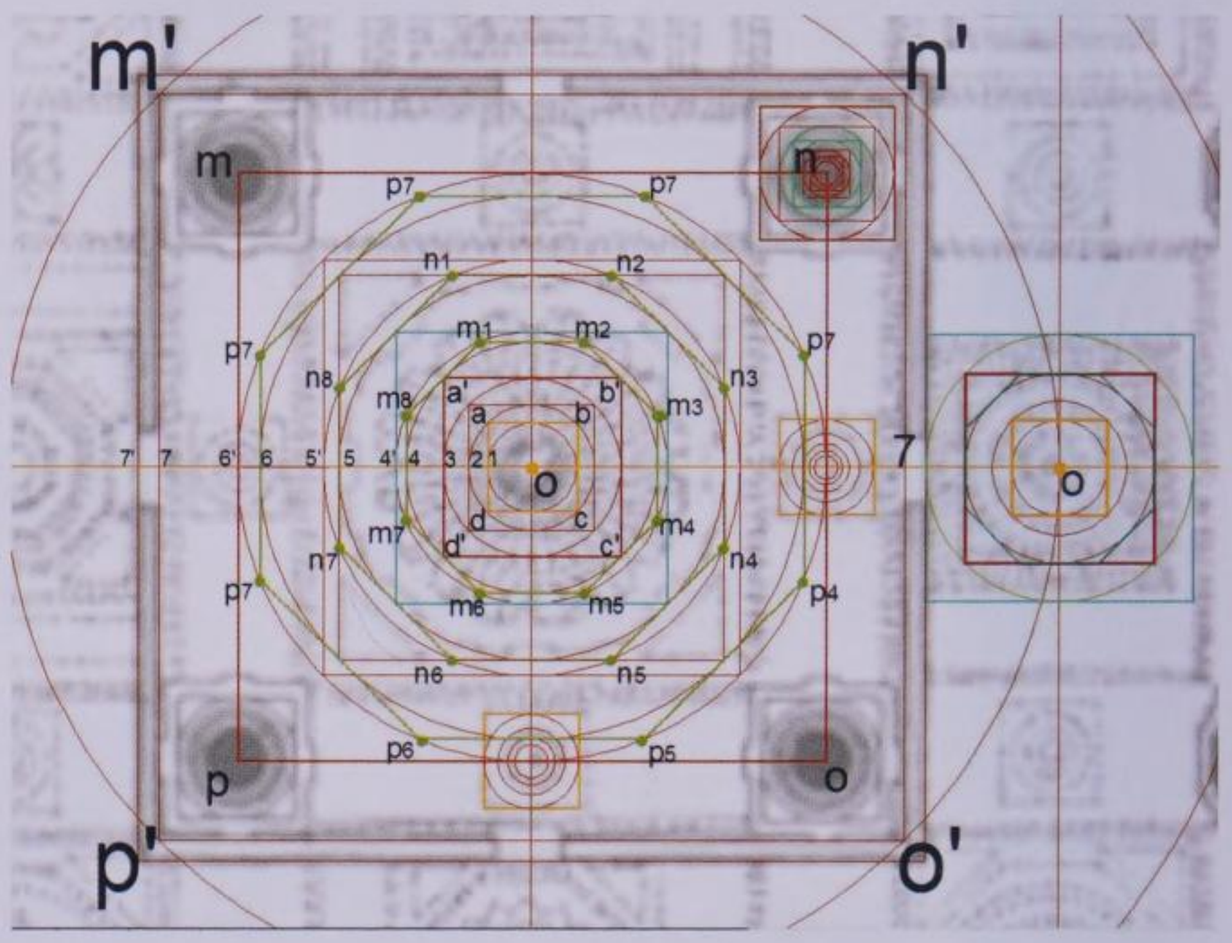


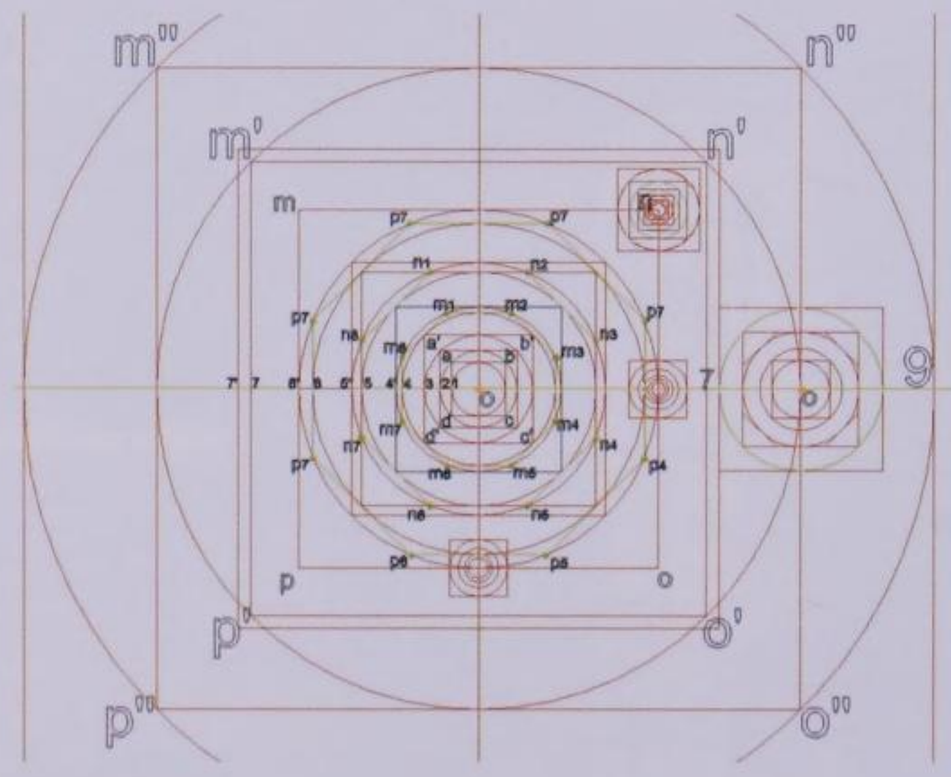


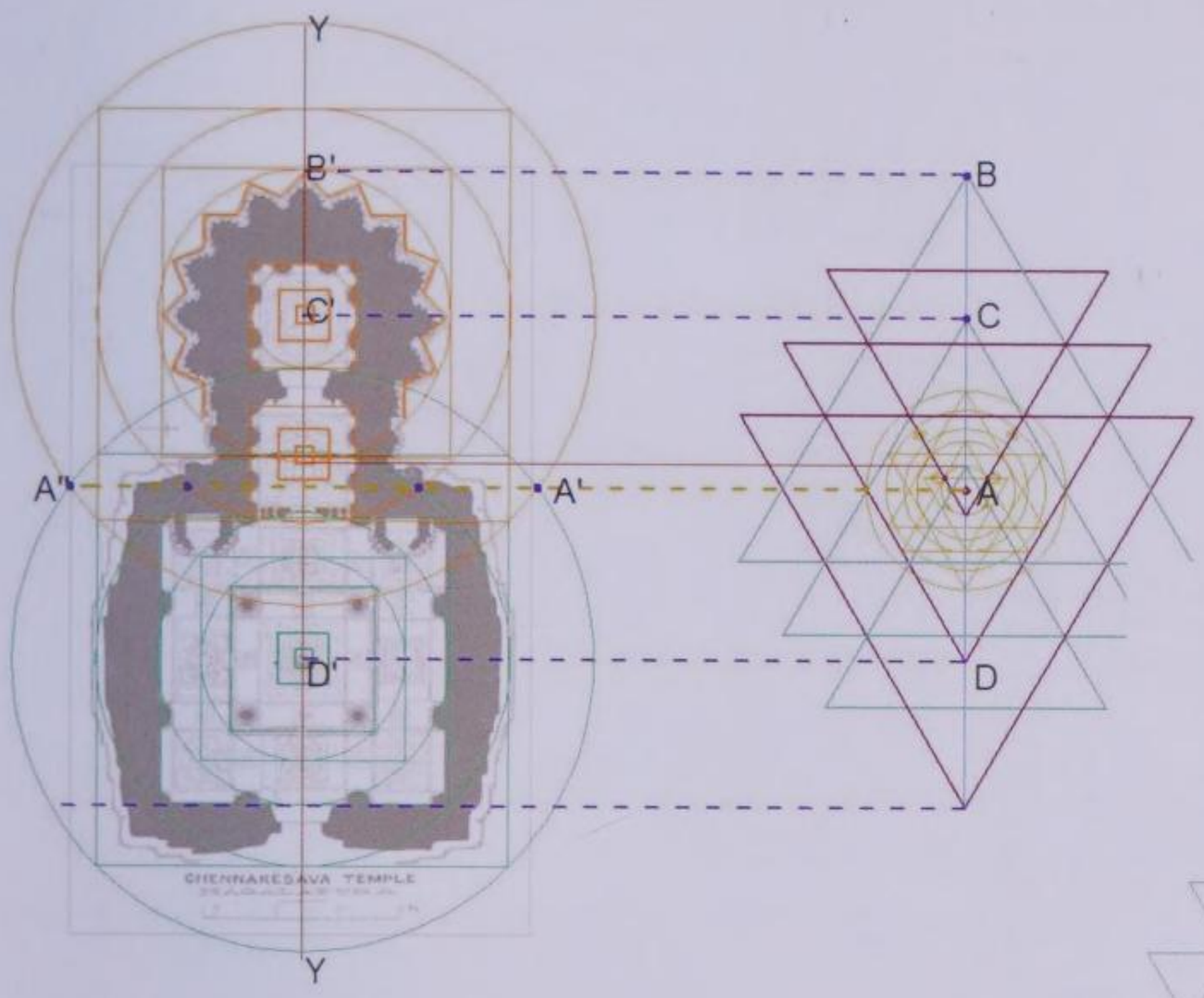
Temple at Nagalapura, Courtesy Gerard Foekema

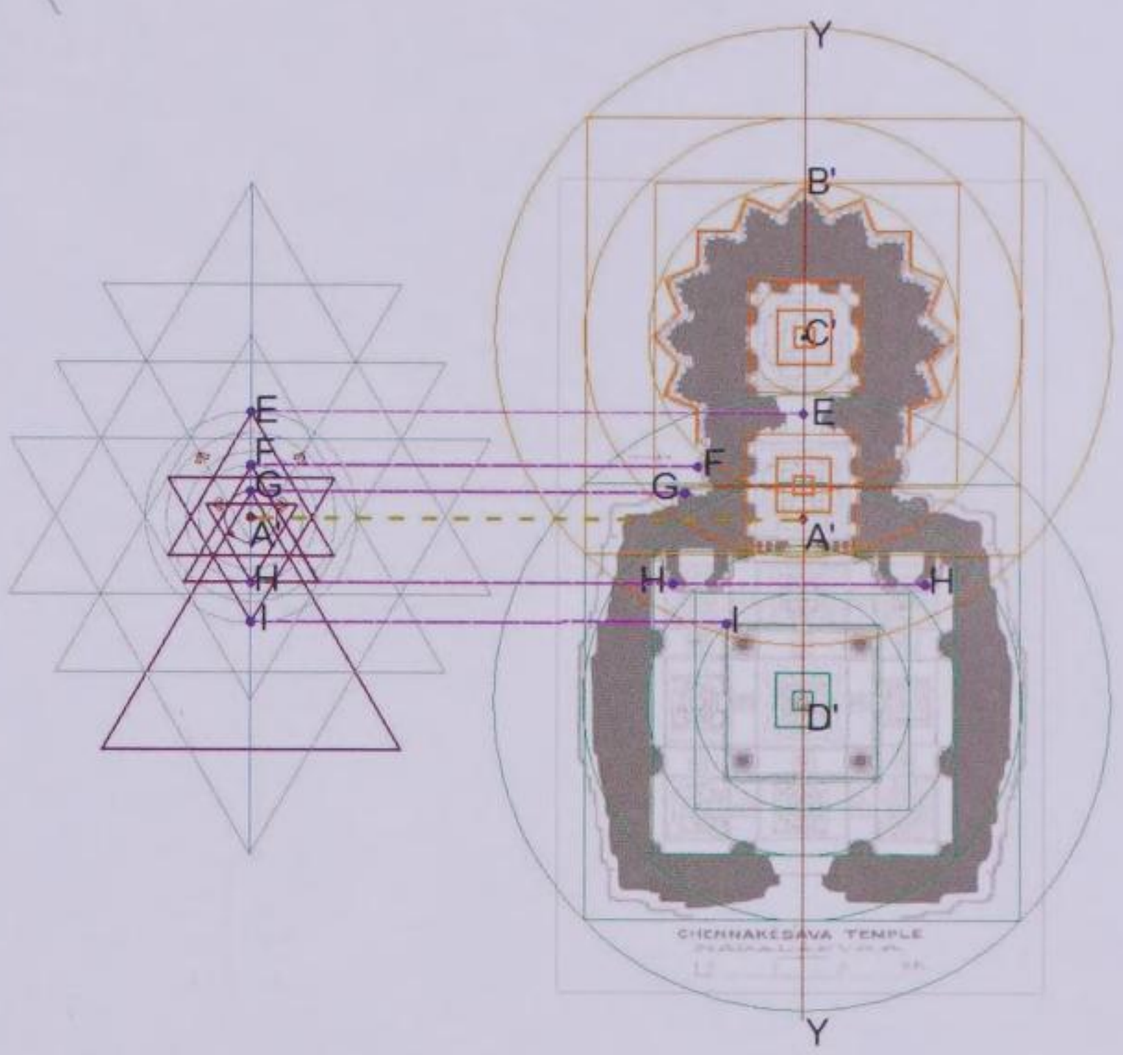

m''
n''
m'
n'
m
n
a
b
h
c
O''
6 7 8
g
d
f
e
p
o
p'
o'
p''
o''

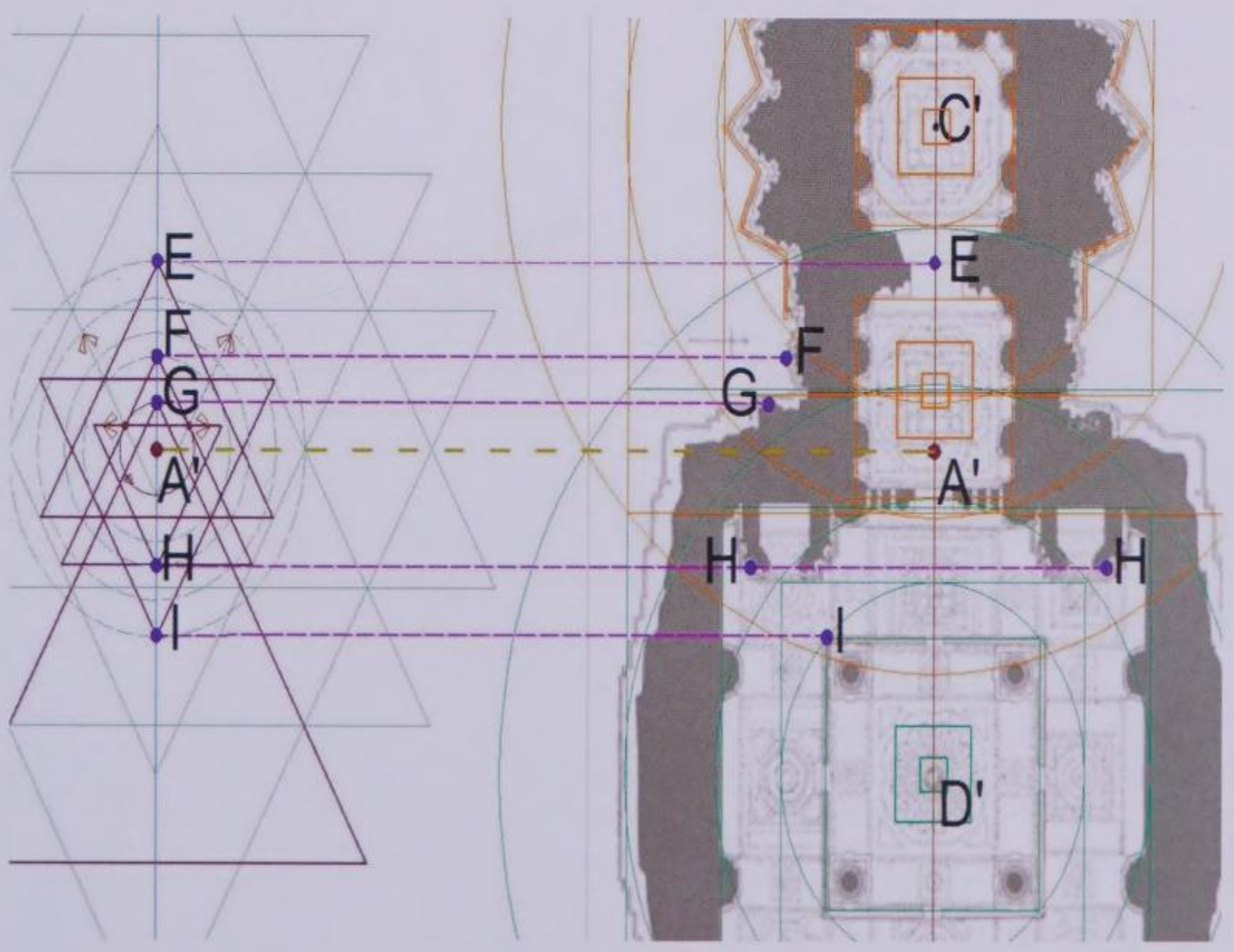

m'''
i
h
n'''
Y
m''
n''
m'
n'
o
4
5'
6
7
o
9
p'
o'
p''
o''
p'''
o'''


m'
n'
m
n
p7
p7
n1
n2
m1
m2
p7
p7
n8
n3
m8
a'
b'
m3
a
b
7' 7 6' 6 5' 5 4' 4 3 2 1
o
7
o
d
c
d'
c'
m7
m4
n7
n4
m6
m5
p7
p4
n6
n5
p6
p5
p
o
p'
o'


m''
n''
m'
n'
m
p7
p7
n1
n2
m1
m2
p7
p7
n8
n3
m8
a'
b'
m3
a
b
7' 7 6' 6 5' 5 4' 4 3 2 1
o
7
o
9
d
c
d'
c'
m7
m4
n7
n4
m6
m5
p7
p4
n6
n5
p6
p5
p
o
p'
o'
p''
o''

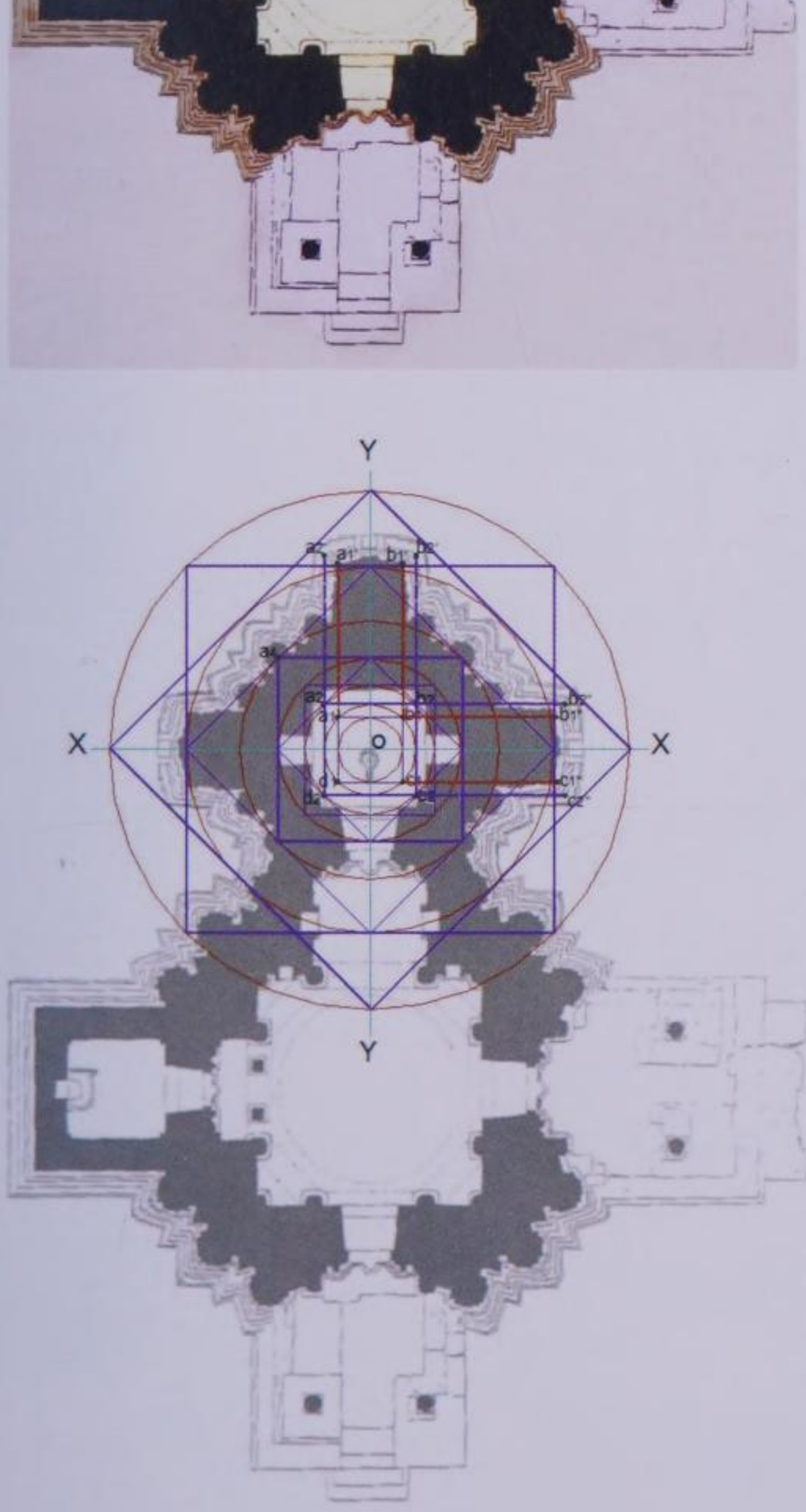

Y
B'
B
C'
C
A'
A
D'
D
Y


Y
B'
C'
E
F
G
A'
H
I
D'
Y

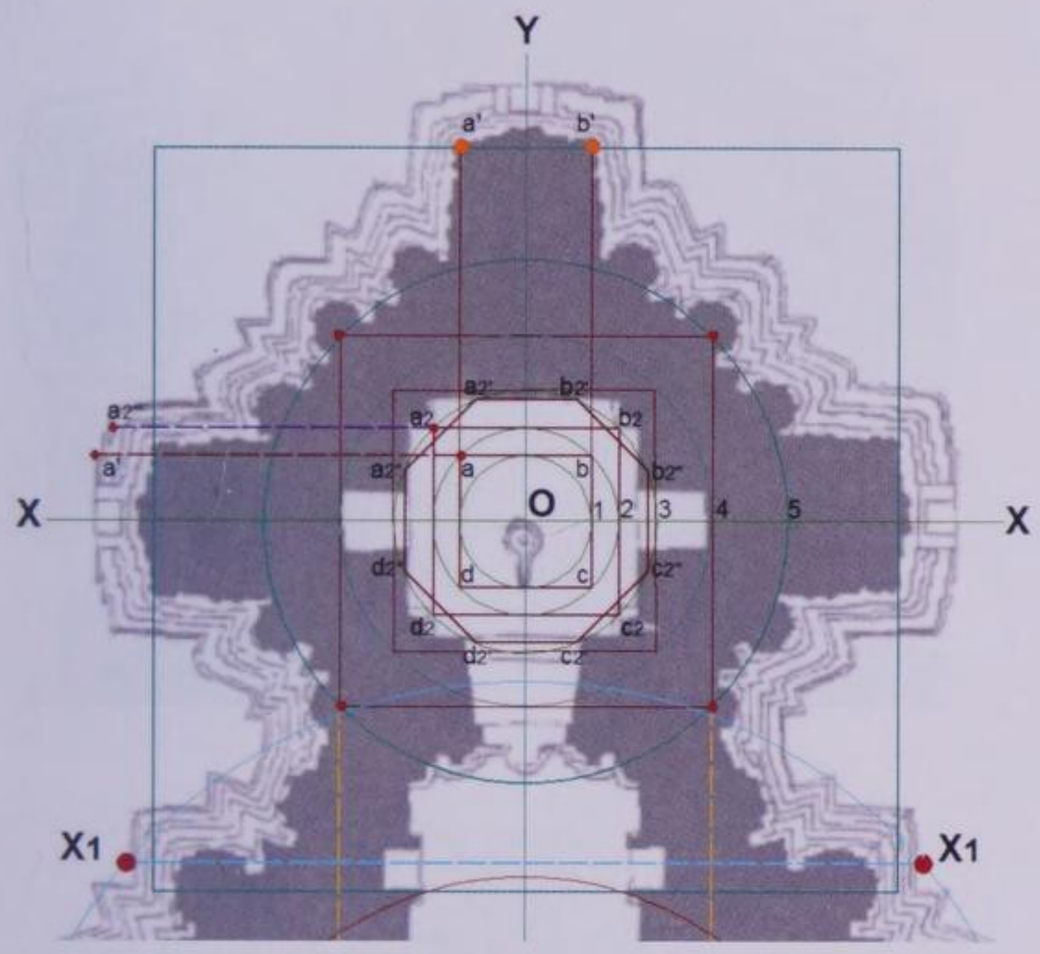

C'
E
F
G
A'
H
I
D'

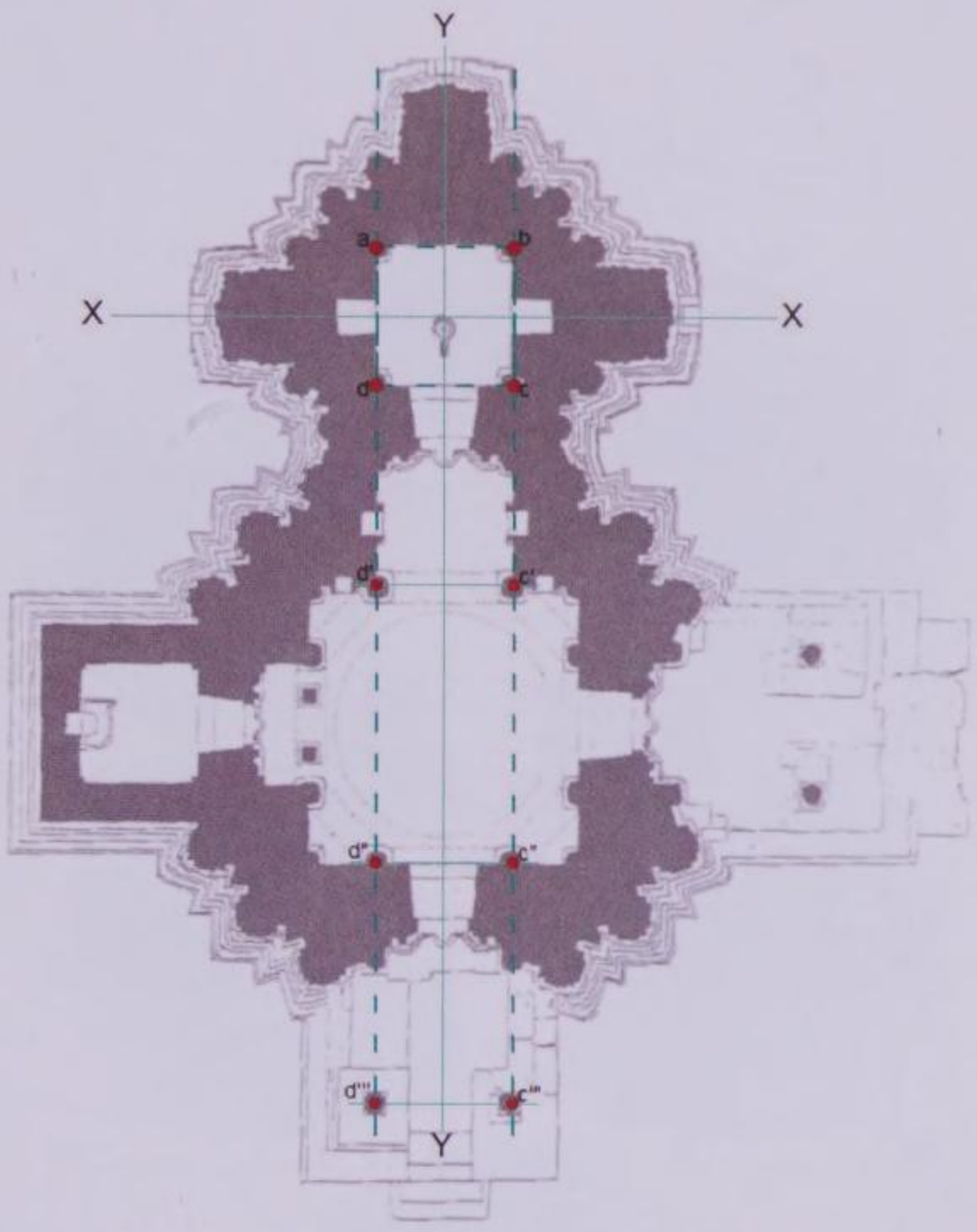
Jagadamba Devi temple,
Kokamtham, Maharashtra,
ca. A.D. fourteenth century,
courtesy Gerard Foekema

9.2 Pictorial Analysis of Jagadamba Devi temple, Kokamtham, Maharashtra, ca. A.D. fourteenth century

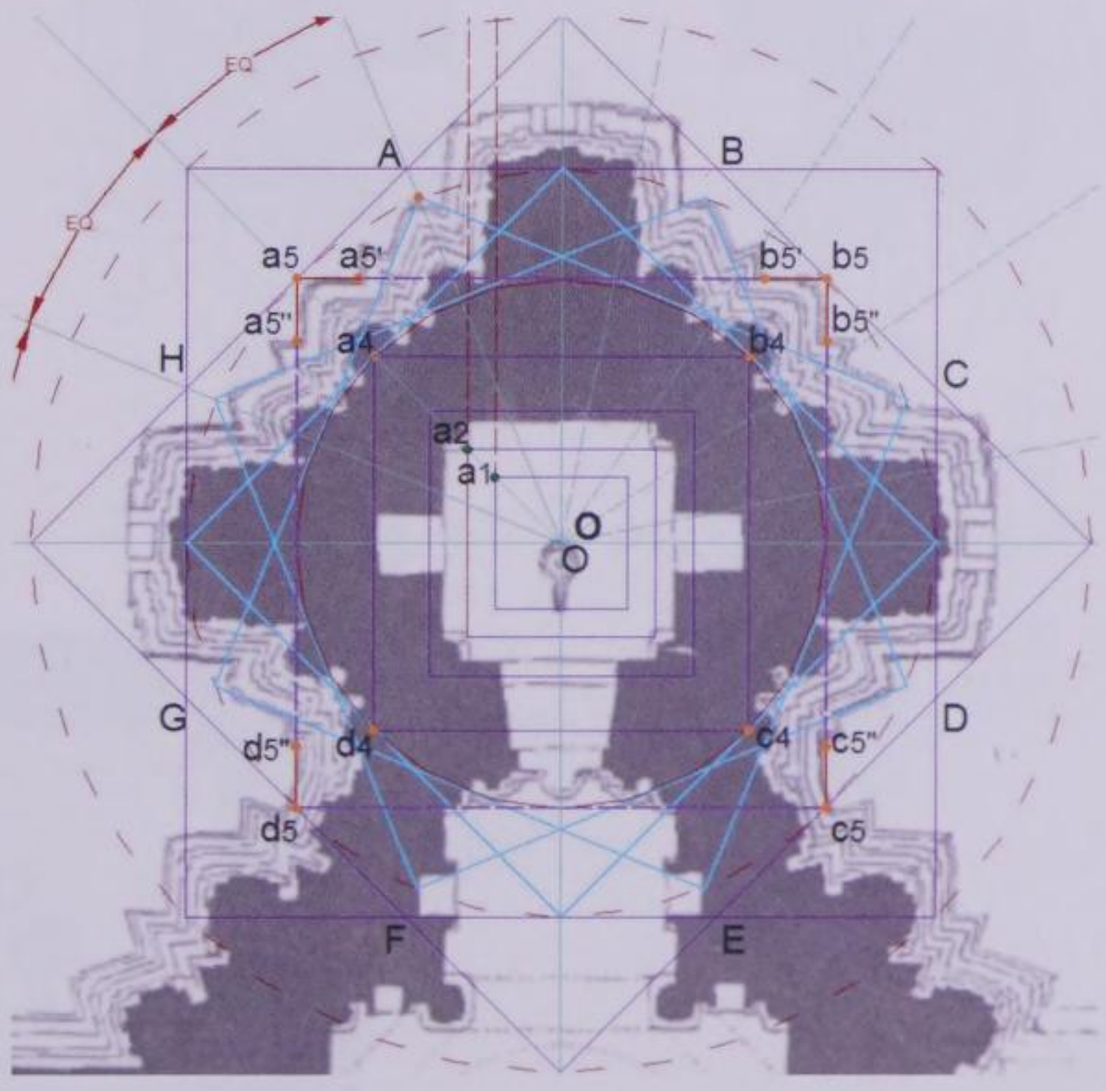


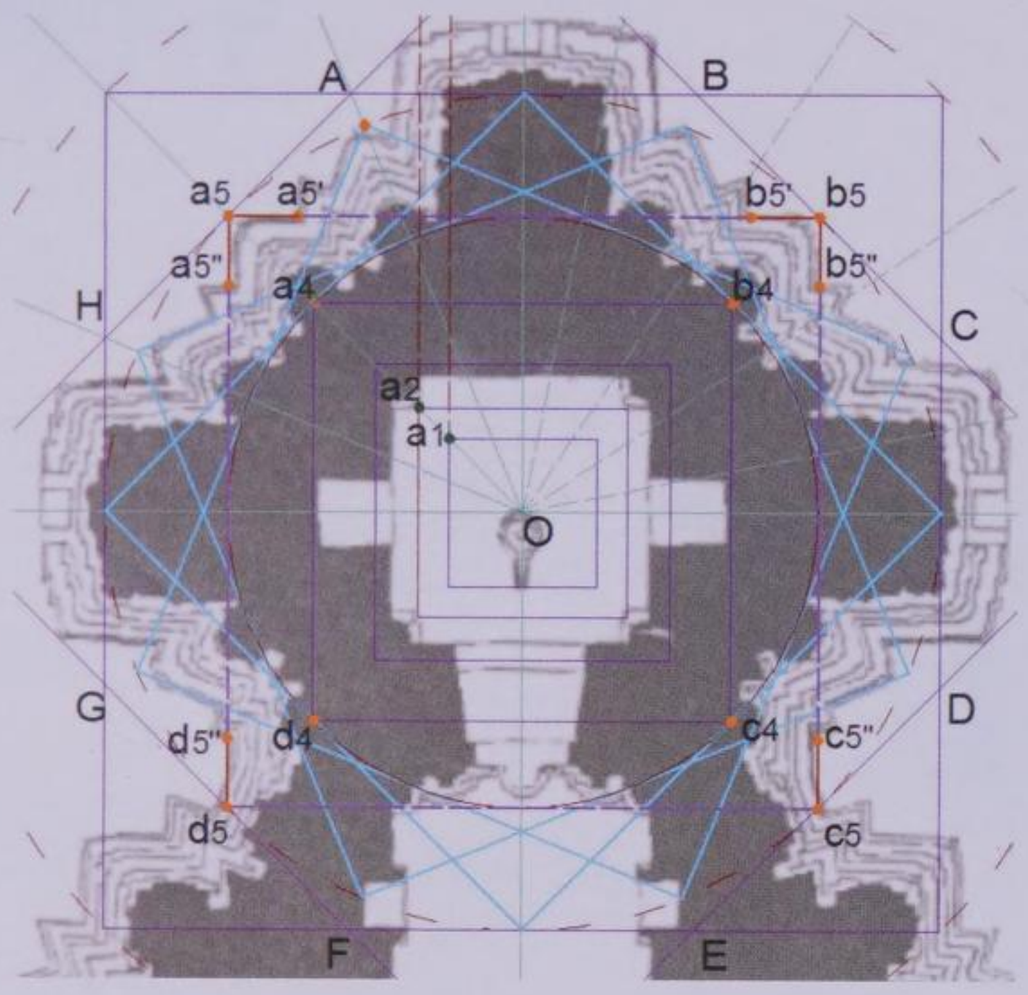
Surya temple, Sasai, Madhya Pradesh

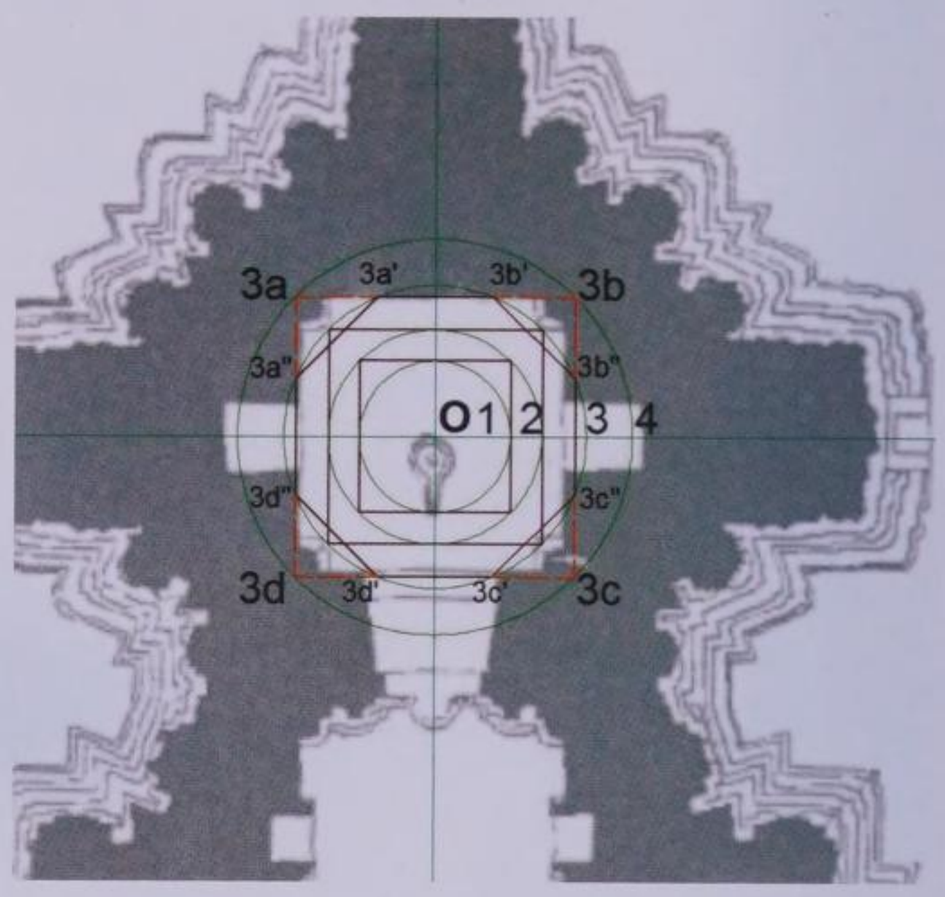

Y
X
X
X1
X1
a'
b'
a2'
b2'
a2''
a2
b2
a'
a2'''
a
b
b2''
O
1
2
3
4
5
d2''
d
c
c2''
d2
c2
d2'
c2'

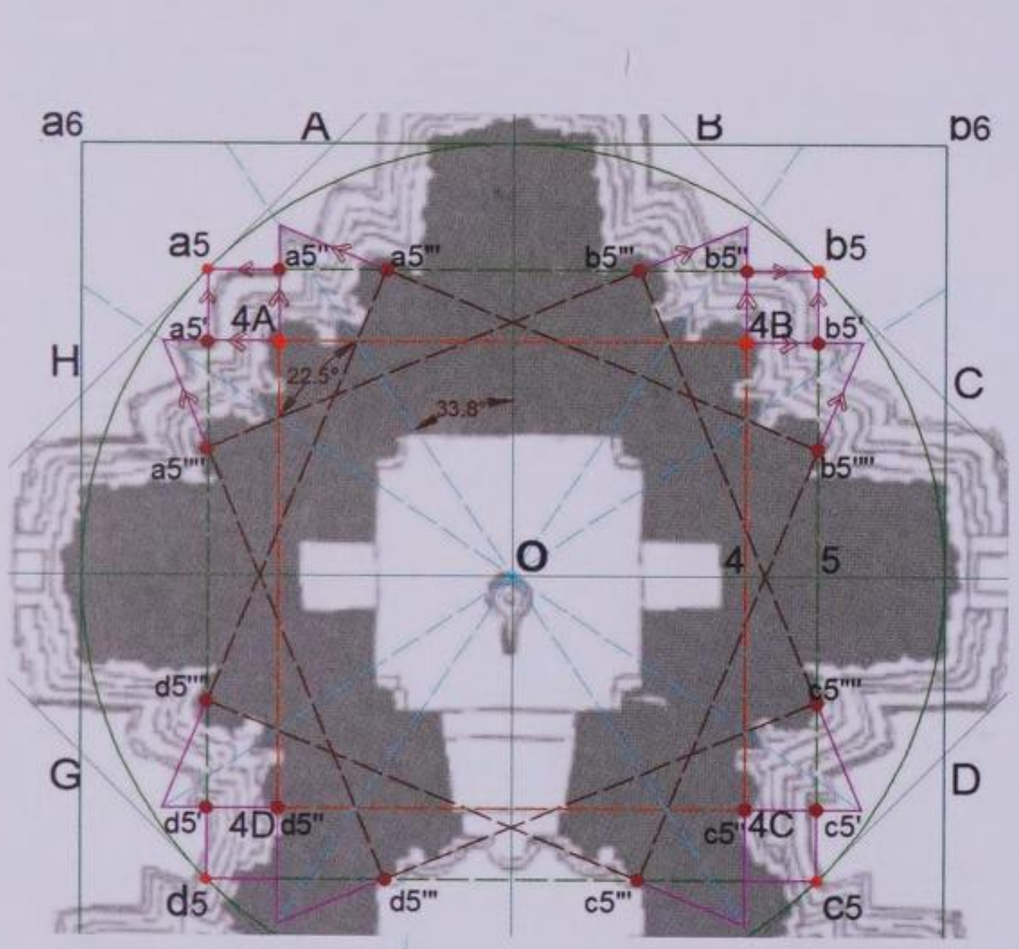

Y
X
X
a
b
d
c
a'
b'
d'
c'
d''
c''
d'''
c'''
Y

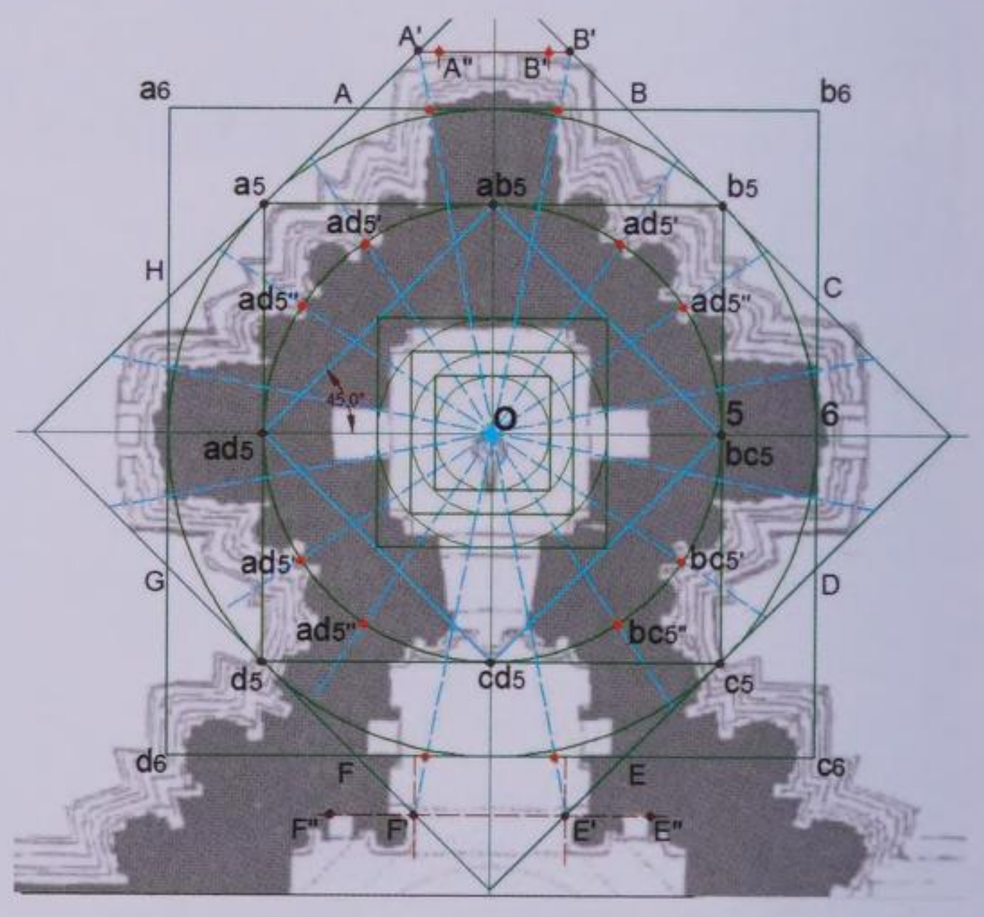
Y
A
B
H
C
G
D
F
E
X
X
O
Y

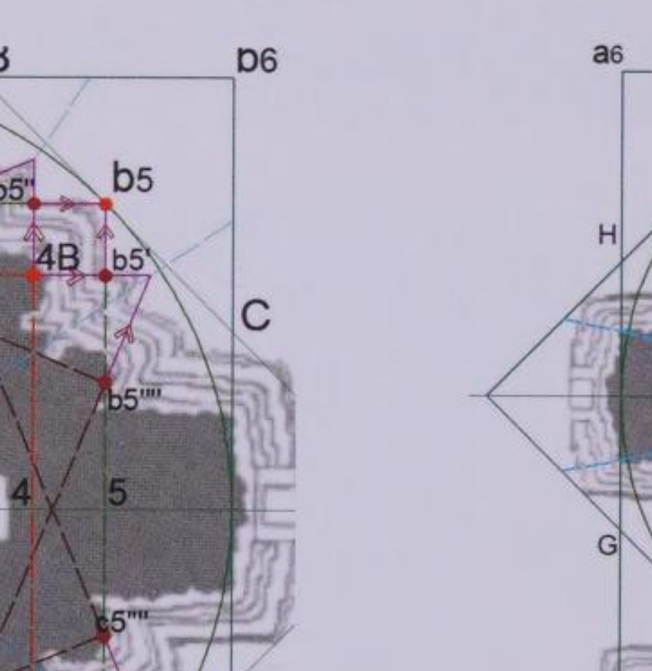

EQ
EQ
A
B
a5
a5'
b5'
b5
a5''
a4
b4
b5''
H
C
a2
a1
O
O
G
d5''
d4
c4
c5''
D
d5
c5
F
E

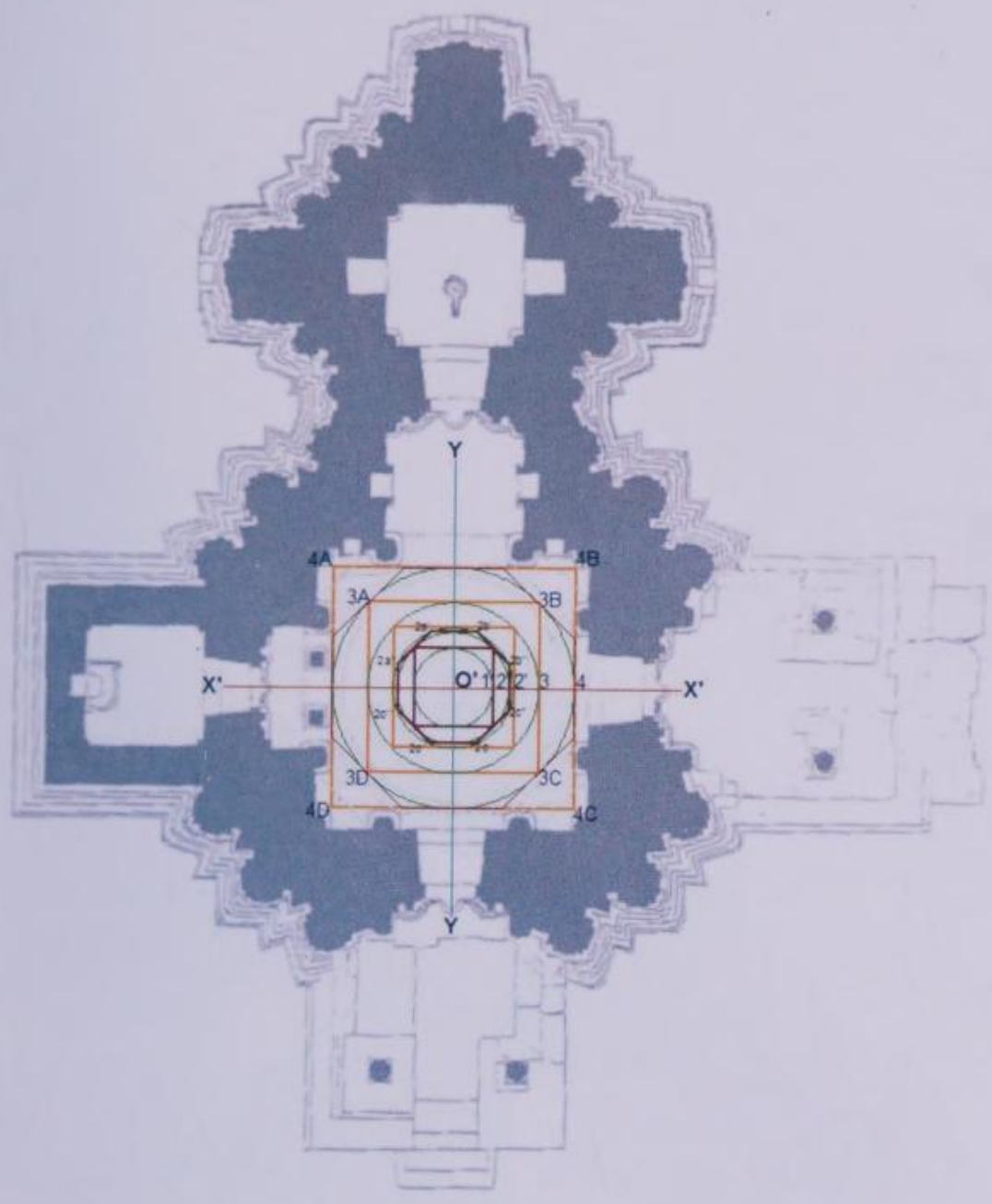

A
B
H
C
G
D
F
E
O
a5
a5'
a5"
a4
a2
a1
b5'
b5
b5"
b4
d5"
d4
d5
c4
c5"
c5

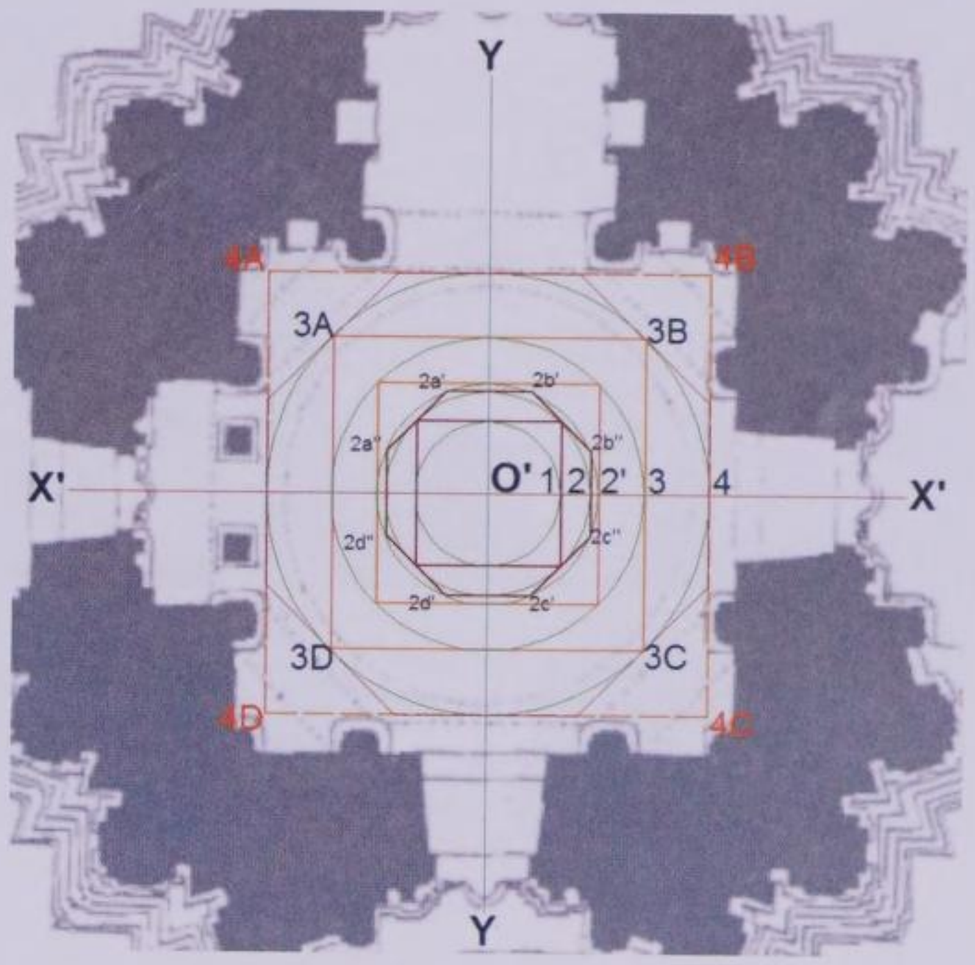

3a
3a'
3b'
3b
3a"
3b"
O1 2 3 4
3d"
3c"
3d
3d'
3c'
3c

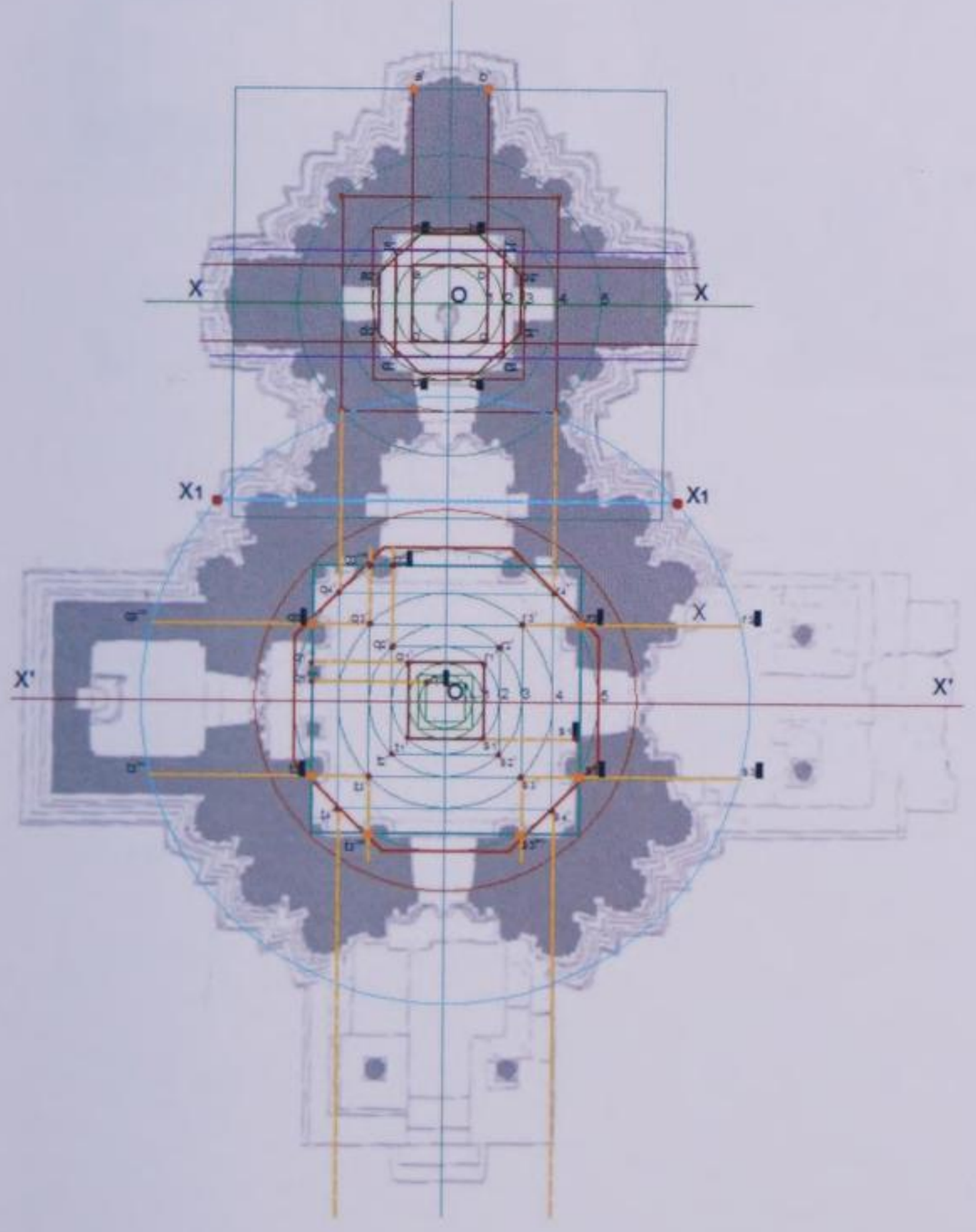

a6
A
B
b6
a5
a5"
a5'''
b5'''
b5"
b5
a5'
4A
4B
b5'
H
22.5°
33.8°
C
a5''''
b5''''
O
4
5
d5''''
c5''''
G
D
d5'
4D
d5"
c5"
4C
c5'
d5
d5'''
c5'''
c5

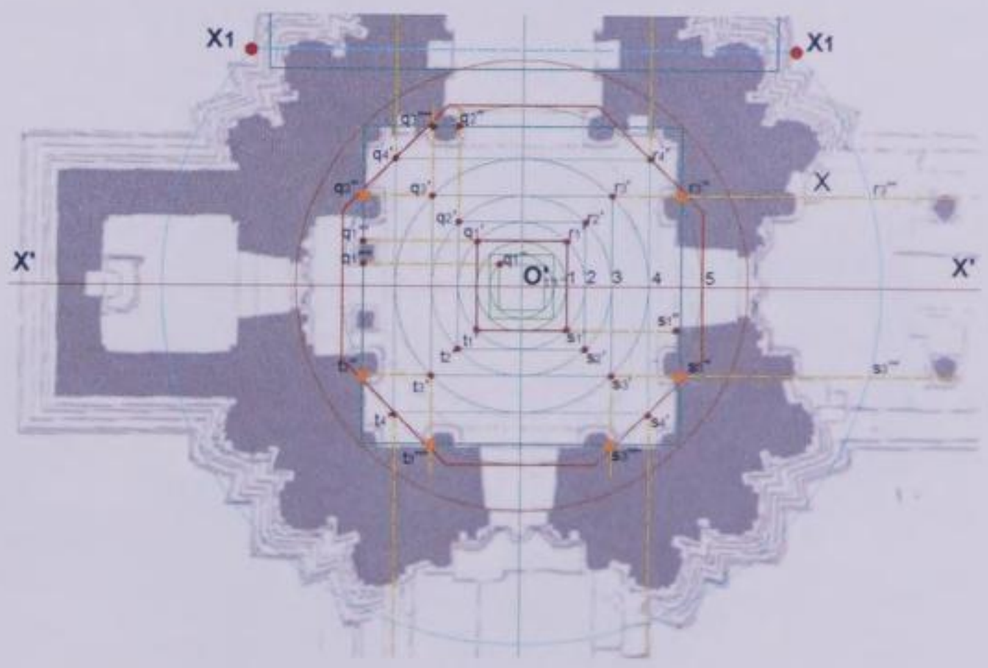

A'
B'
A"
B"
a6
A
B
b6
a5
ab5
b5
ad5'
ad5'
H
ad5"
ad5"
C
45.0°
O
5
6
ad5
bc5
ad5'
bc5'
G
D
ad5"
bc5"
d5
cd5
c5
d6
F
E
c6
F"
F'
E'
E"

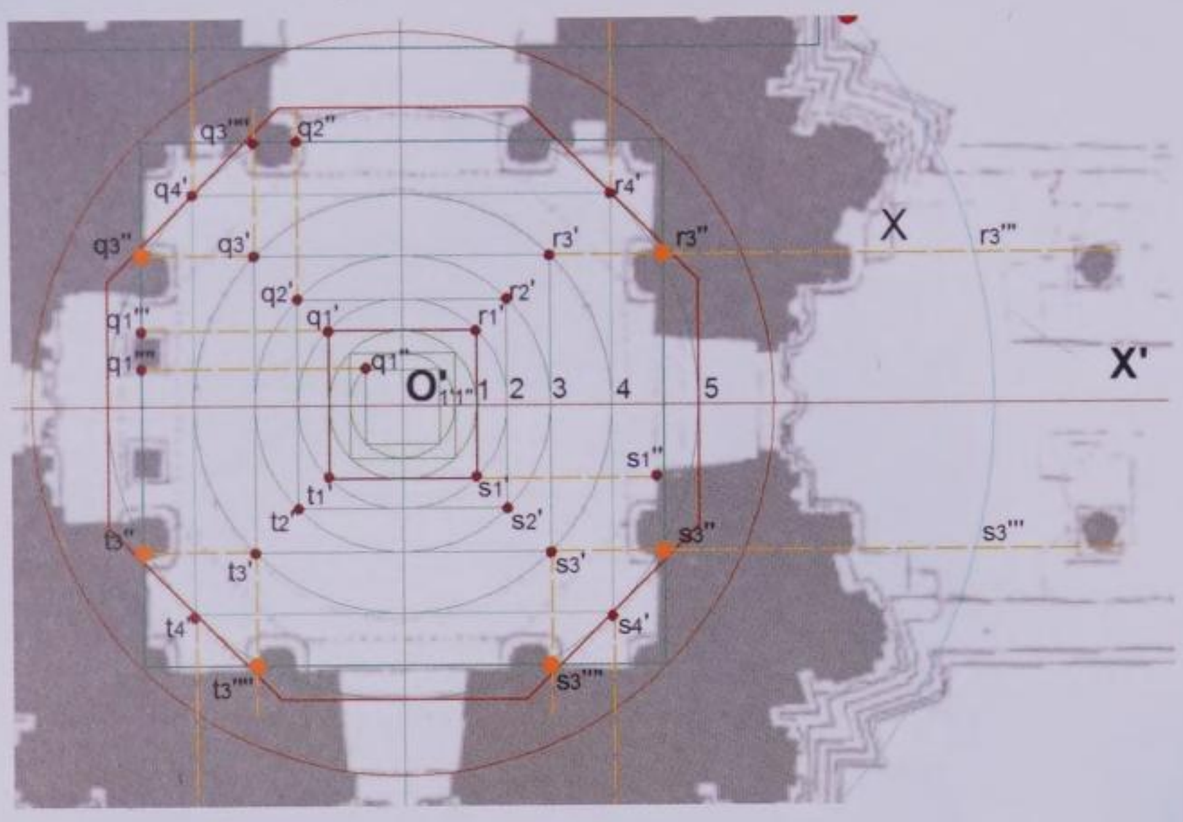

3a
3a'
3b'
3b
3a"
3b"
O1 2 3 4
3d"
3c"
3d
3d'
3c'
3c

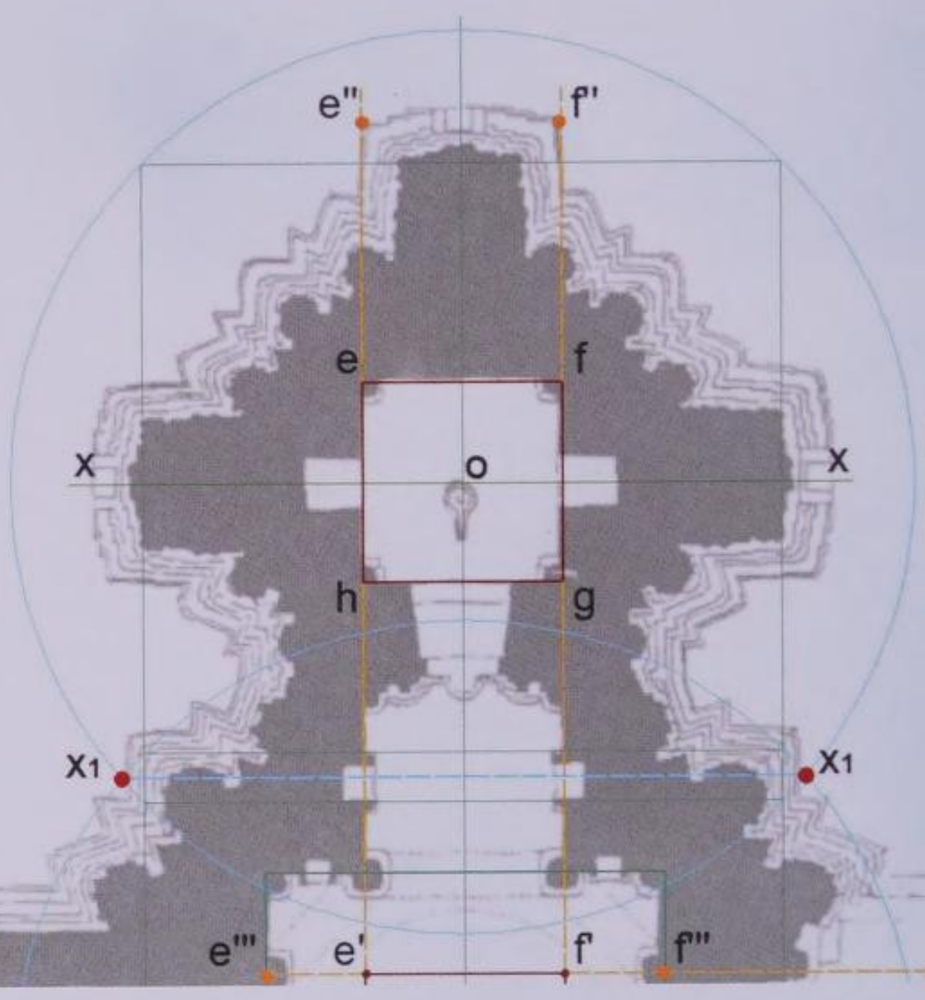

Y
4A
4B
3A
3B
X'
O'
1
2
2'
3
4
X'
3D
3C
4D
4C
Y

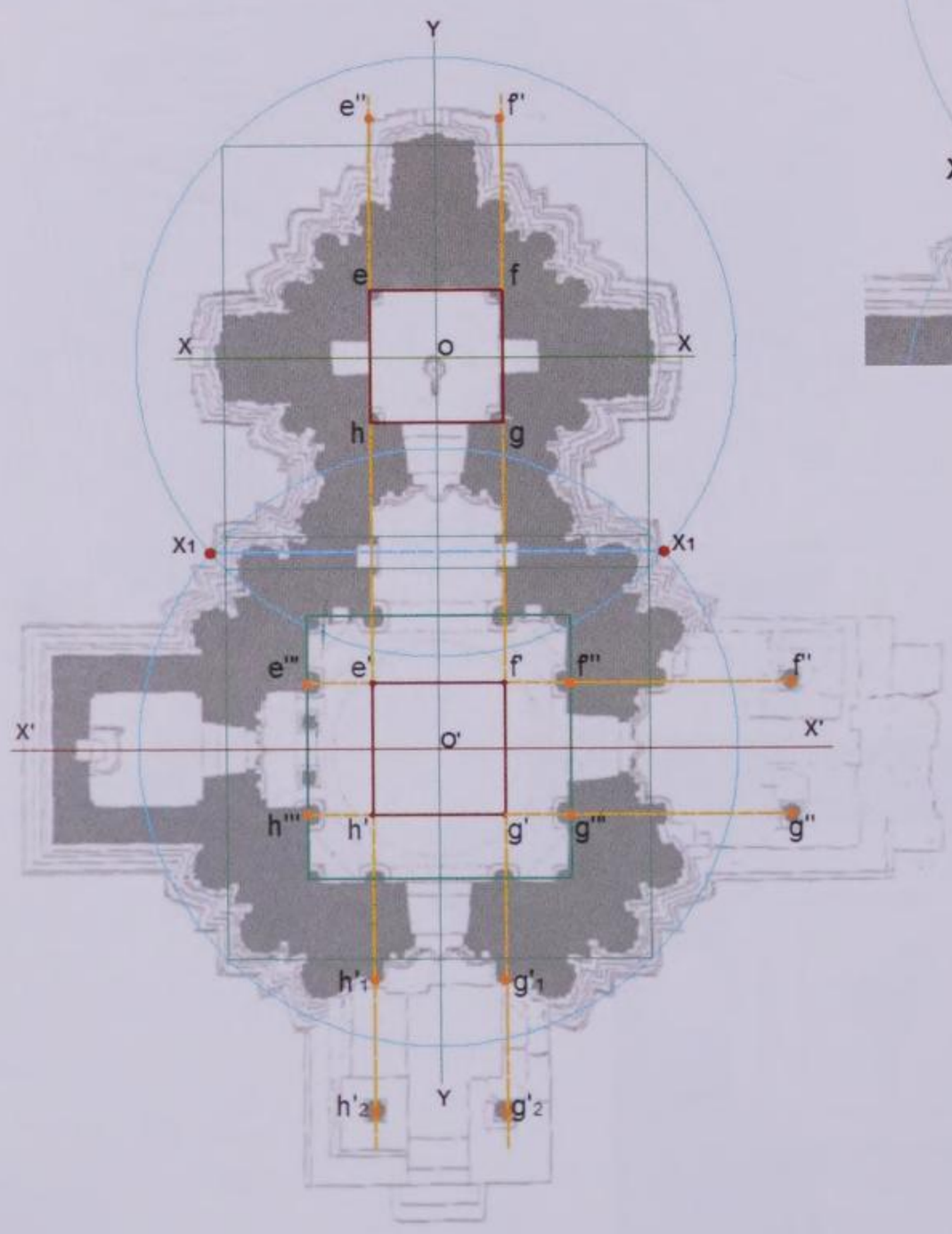

Y
4A
4B
3A
3B
2a'
2b'
2a''
2b''
X'
O'
1
2
2'
3
4
X'
2d''
2c''
2d'
2c'
3D
3C
4D
4C
Y

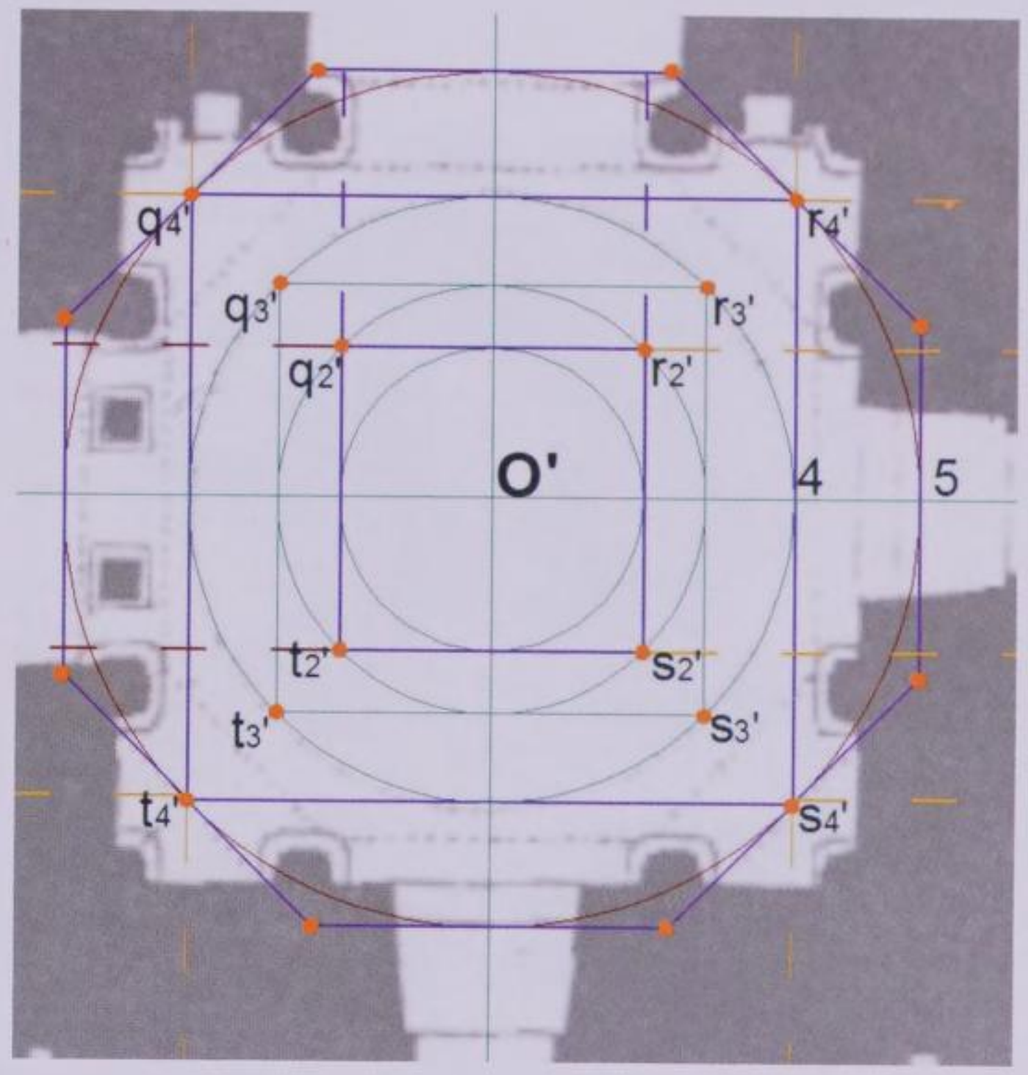

X
O
X
X1
X1
X
X'
X'

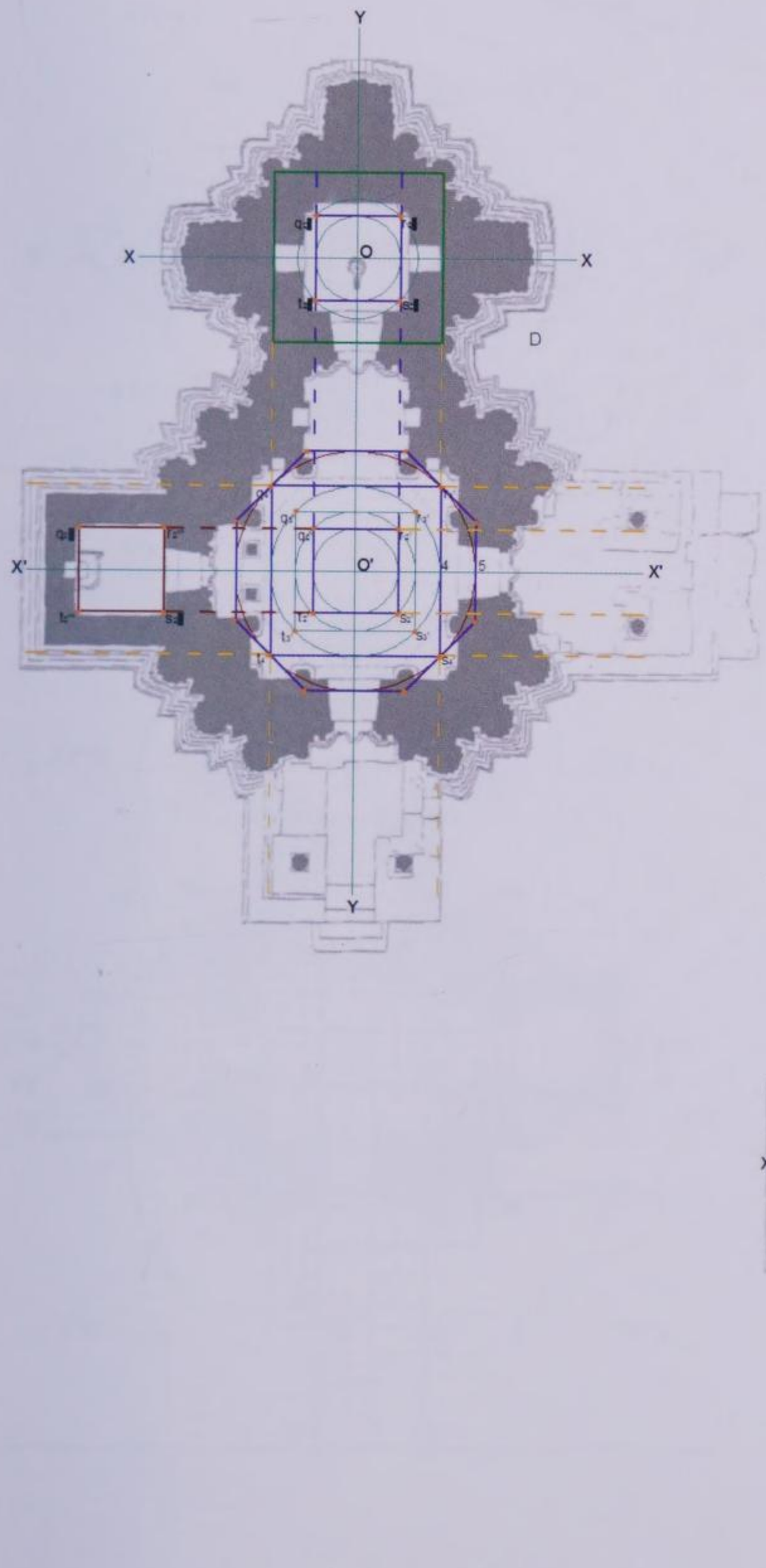

X1
X1
X
X'
X'

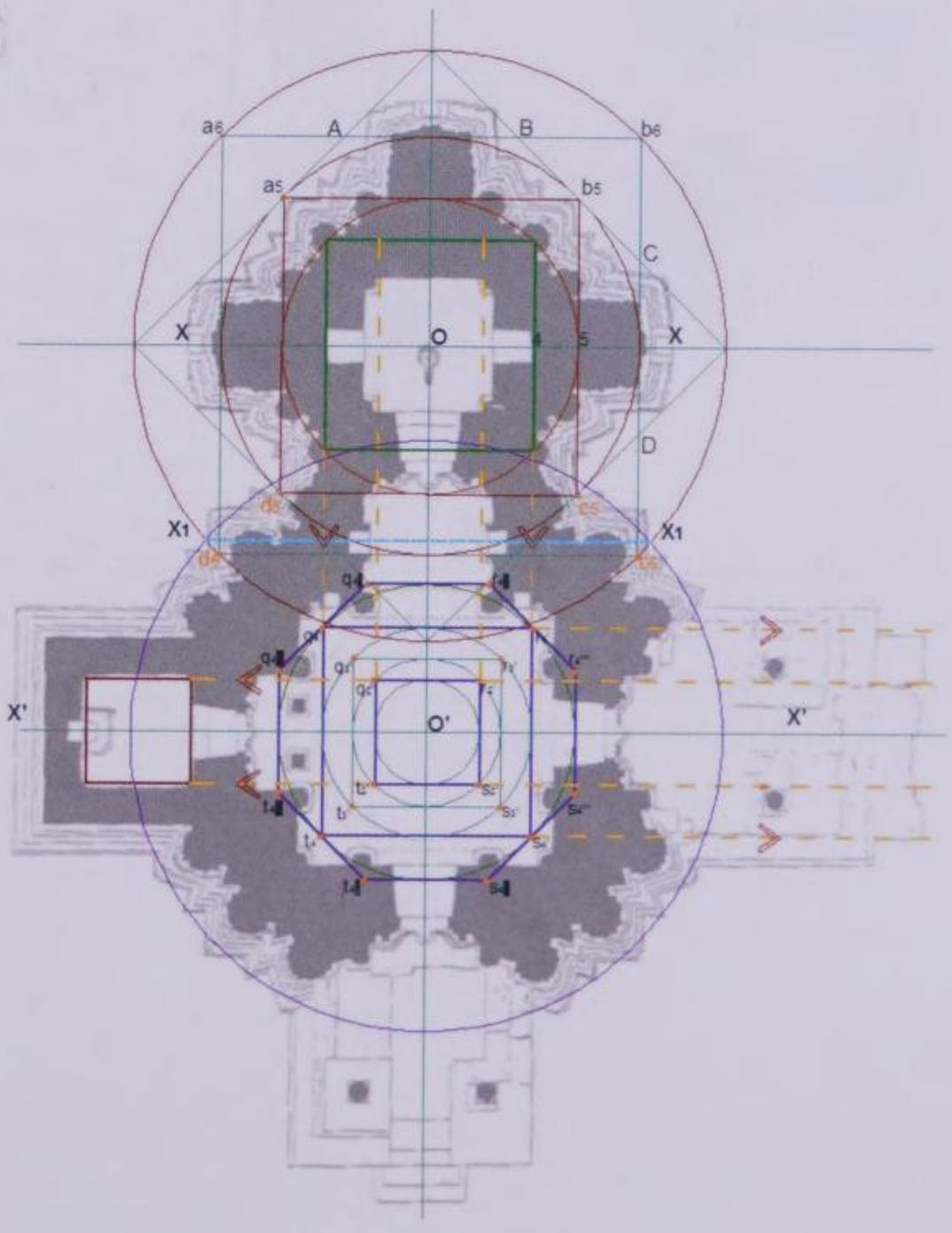

q3'''' q2''
q4' r4'
q3'' q3' r3' r3'' X r3'''
q2' r2'
q1'' q1' r1'
q1''' q1''
O' 1 2 3 4 5 X'
s1''
t1' s1'
t2 s2'
t3'' s3'' s3'''
t3' s3'
t4 s4'
t3'''' s3''''

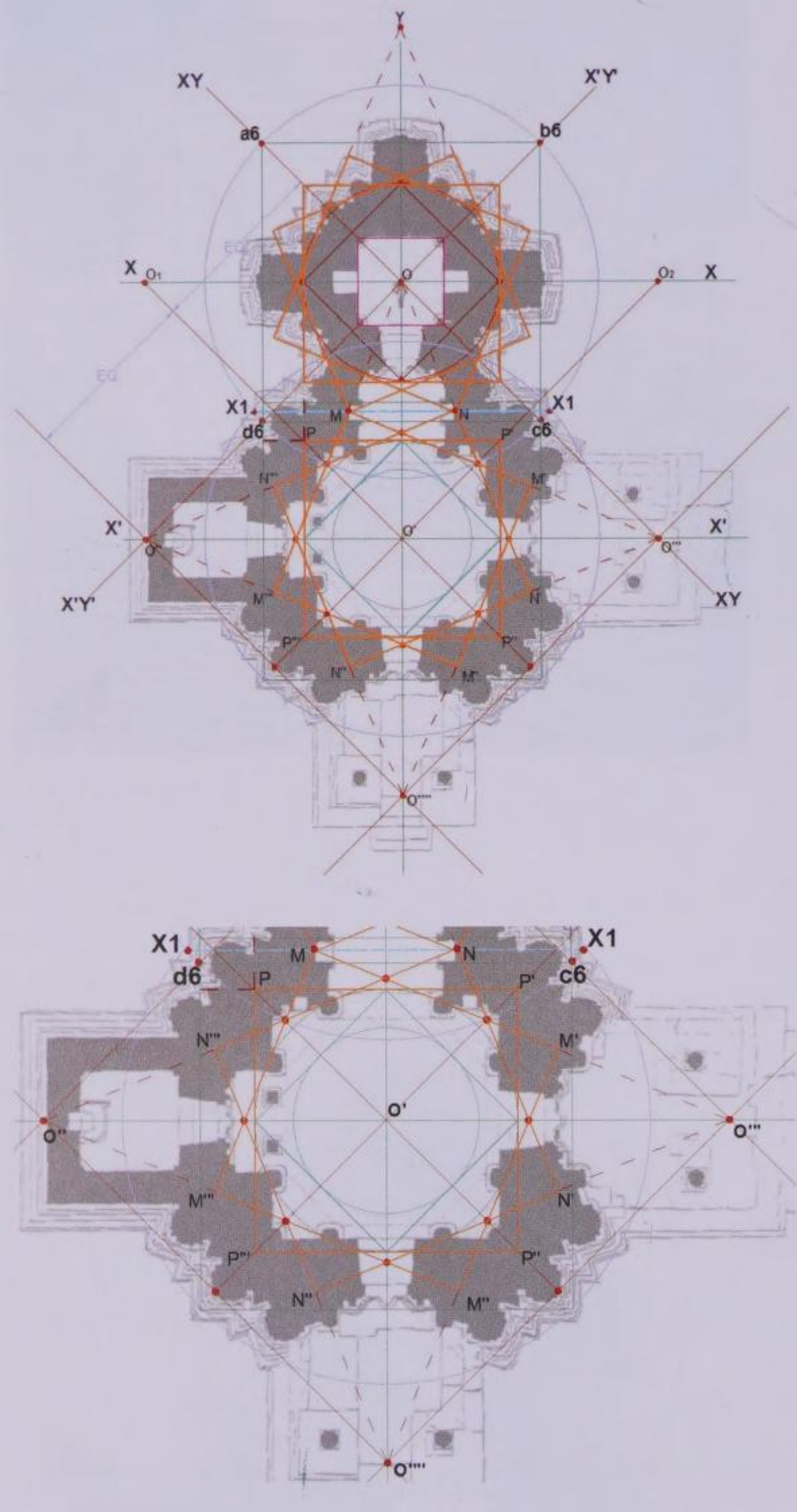

e'' f'
e f
X o X
h g
X1 X1
e''' e' f' f'' f'

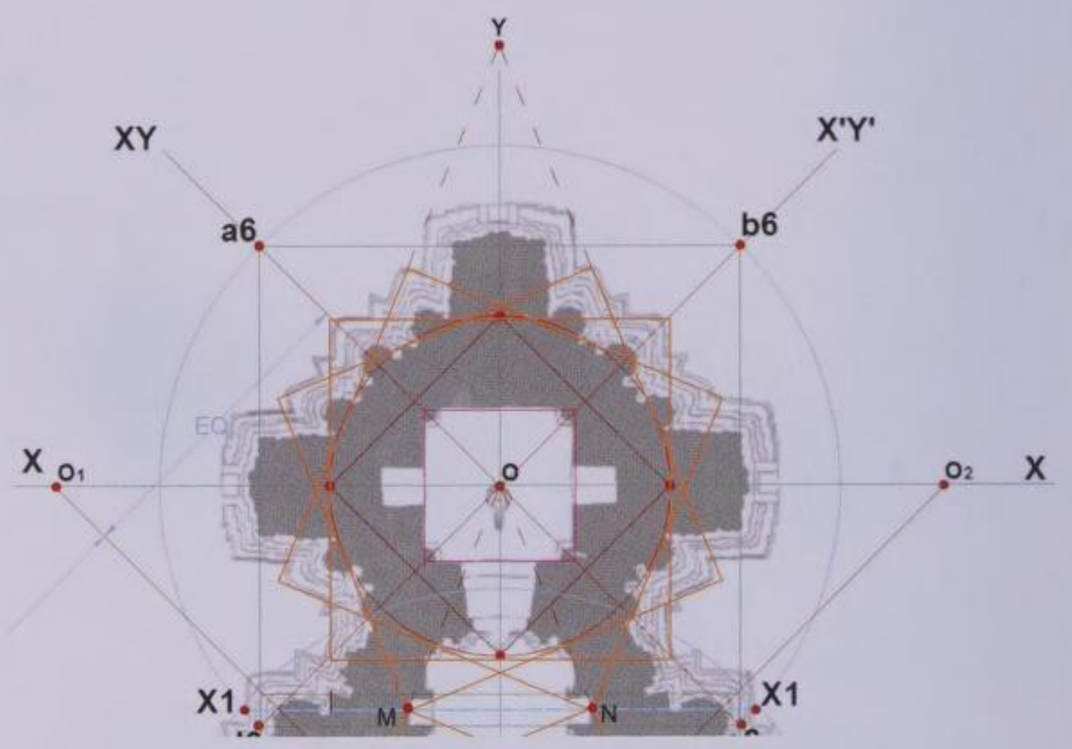

Y
e'' f'
e f
X o X
h g
X1 X1
e''' e' f' f'' f'
X' o' X'
h''' h' g' g''' g''
h'1 g'1
h'2 Y g'2

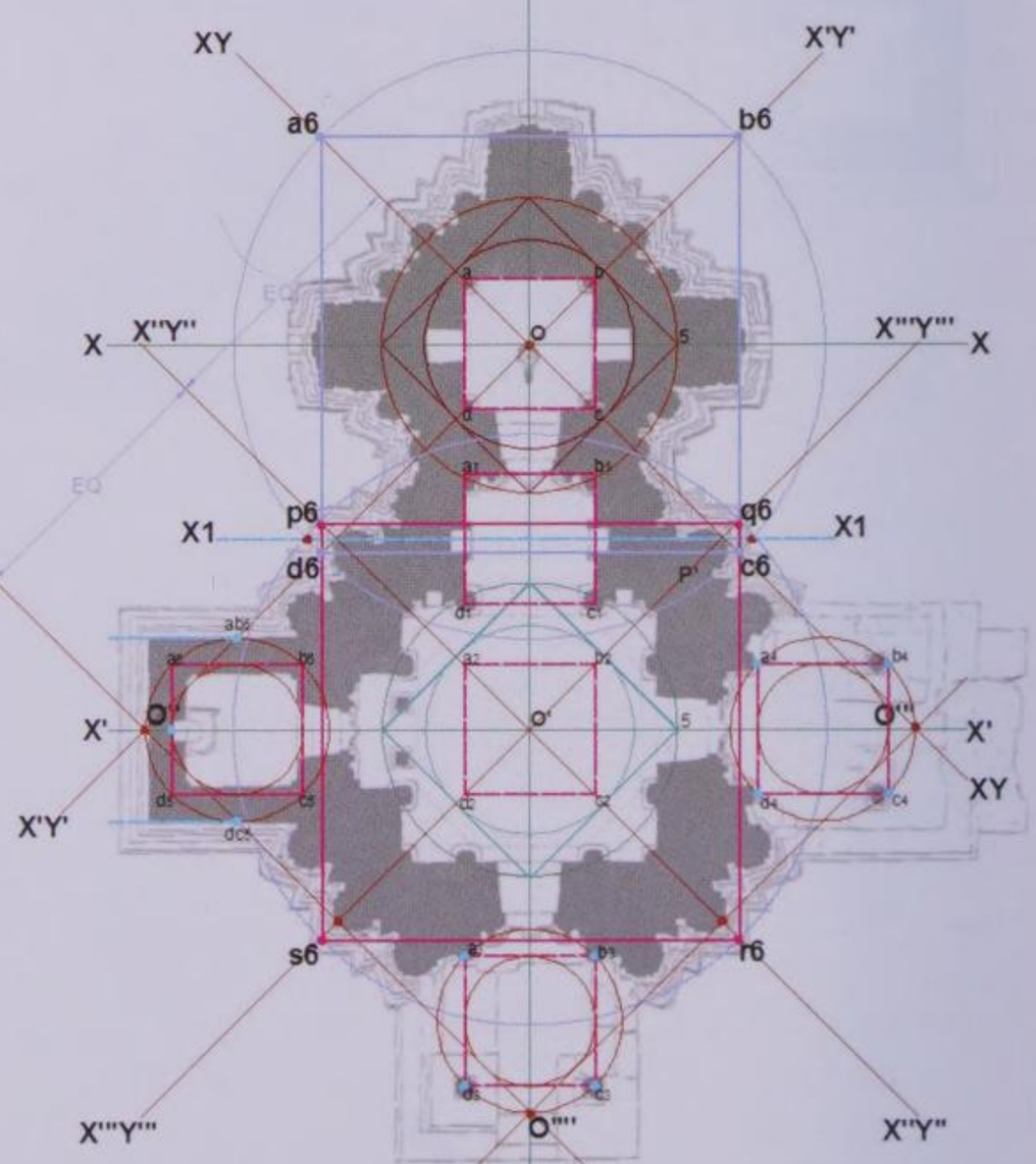

q4'
r4'
q3'
r3'
q2'
r2'
O'
4
5
t2'
s2'
t3'
s3'
t4'
s4'

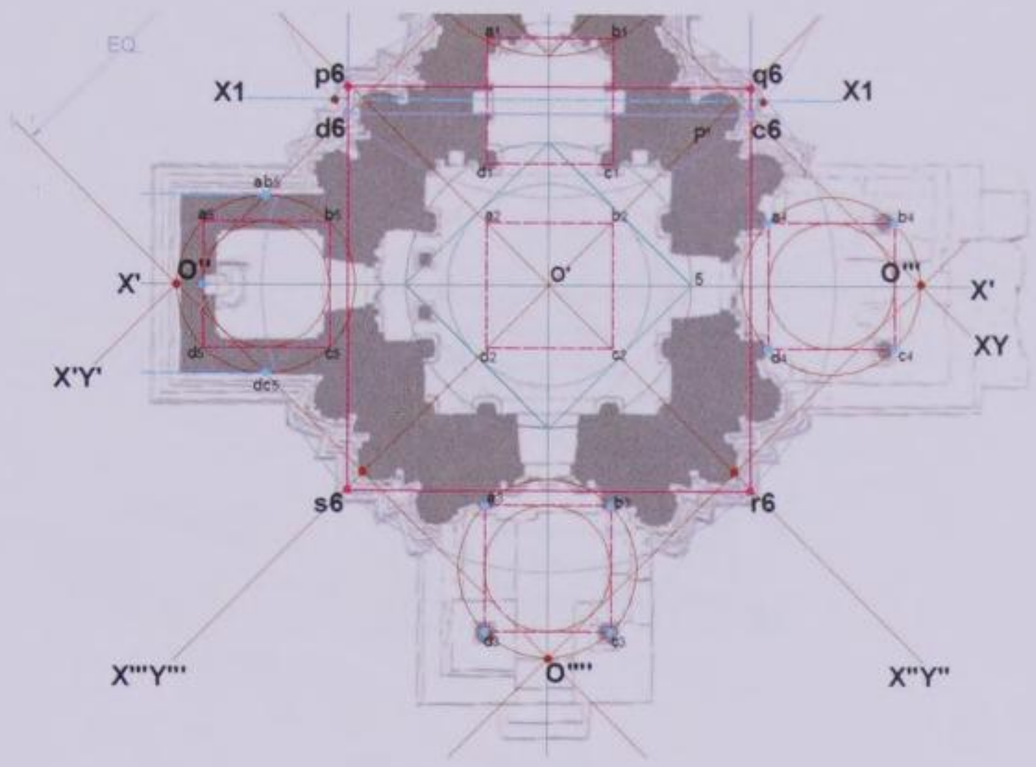

Y
X
X
O
D
X'
X'
O'
4
5
Y

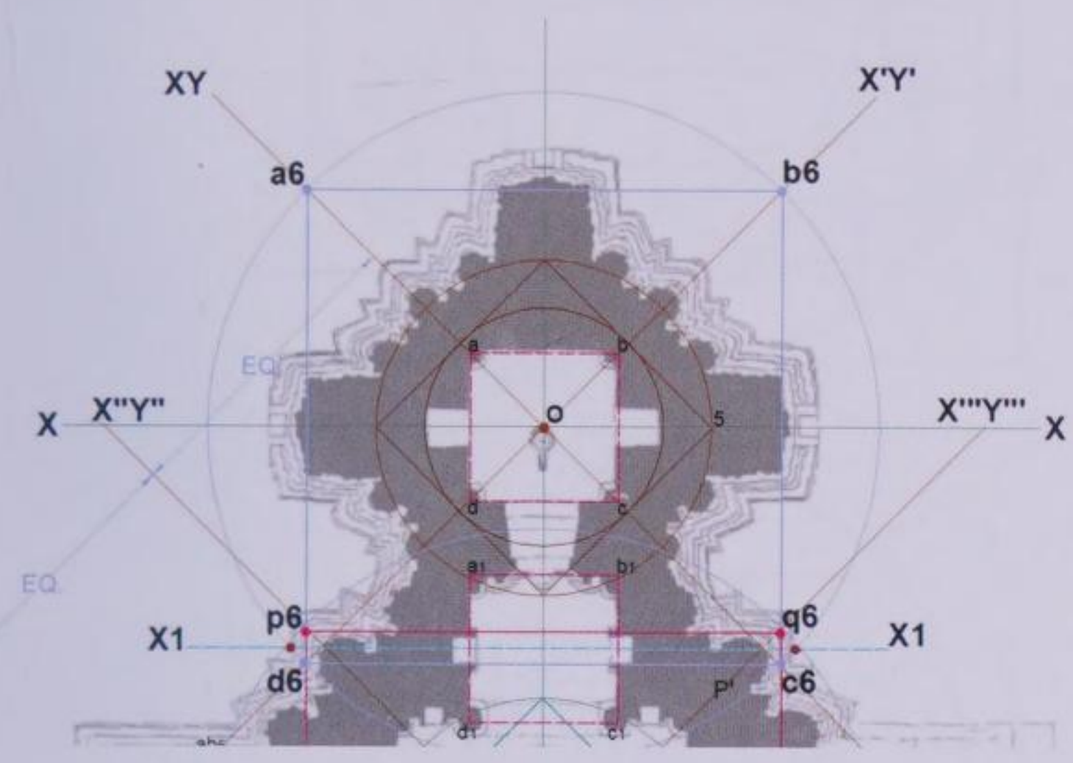

a6
A
B
b6
a5
b5
C
X
X
O
5
D
X1
X1
X'
X'
O'

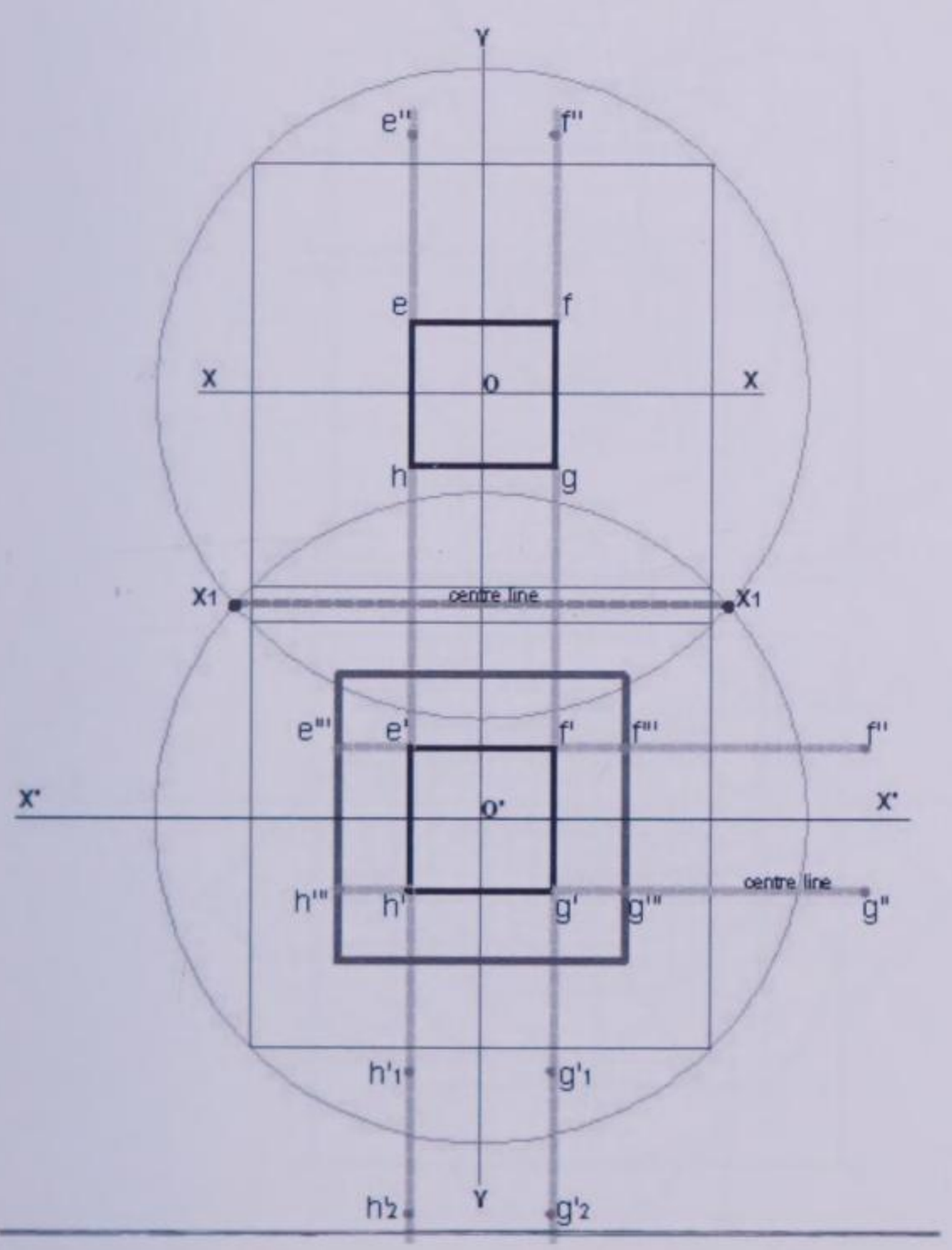

Y
XY
X'Y'
a6
b6
X
O1
O2
X
X1
X1
d6
c6
M
N
P
P'
N'''
M'
X'
X'
O'
O'''
X'Y'
XY
M'''
N'
P'''
P'
N''
M''
O''''
X1
X1
d6
c6
M
N
P
P'
N'''
M'
O'
O''
O'''
M'''
N'
P'''
P''
N''
M''
O''''

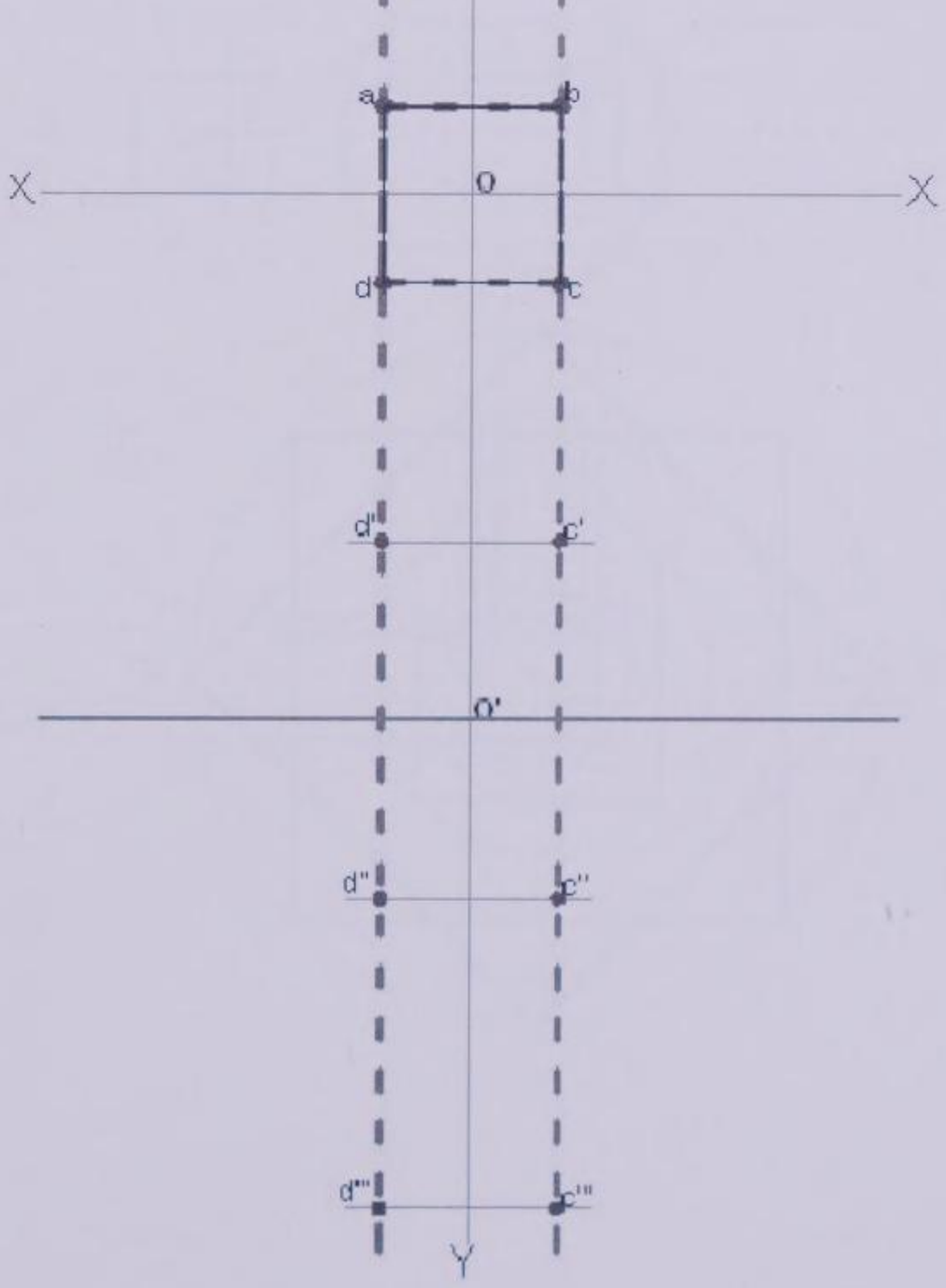

Y
XY
X'Y'
a6
b6
X
O1
O2
X
X1
X1
M
N

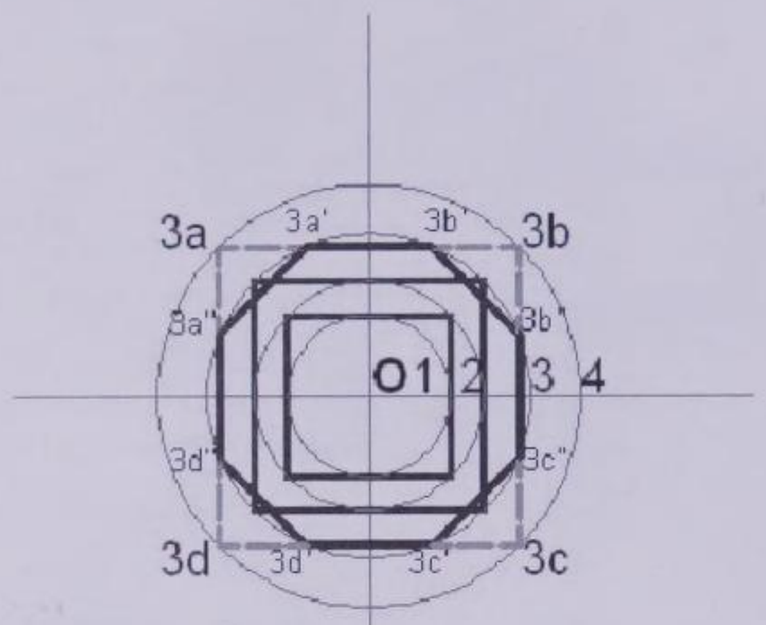

XY
X'Y'
a6
b6
X
X''Y''
X'''Y'''
X
EQ
X1
p6
q6
X1
d6
c6
X'
O
O'
O'''
X'
XY
X'Y'
s6
r6
X'''Y'''
O''''
X''Y''


EQ.
X1
p6
q6
X1
d6
c6
P'
X'
O''
O'
O'''
X'
X'Y'
XY
s6
r6
X'''Y'''
O''''
X''Y''


XY
X'Y'
a6
b6
EQ.
X
X''Y''
O
5
X'''Y'''
X
d
c
a1
b1
EQ.
X1
p6
q6
X1
d6
P'
c6
d1
c1


Y
e''
f''
e
f
X
o
X
h
g
X1
centre line
X1
e'''
e'
f'
f'''
f''
X'
o'
X'
h'''
h'
g'
g'''
centre line
g''
h'1
g'1
h'2
Y
g'2


Y
a
b
X
o
X
d
c
d'
c'
o'
d''
c''
d'''
c'''
Y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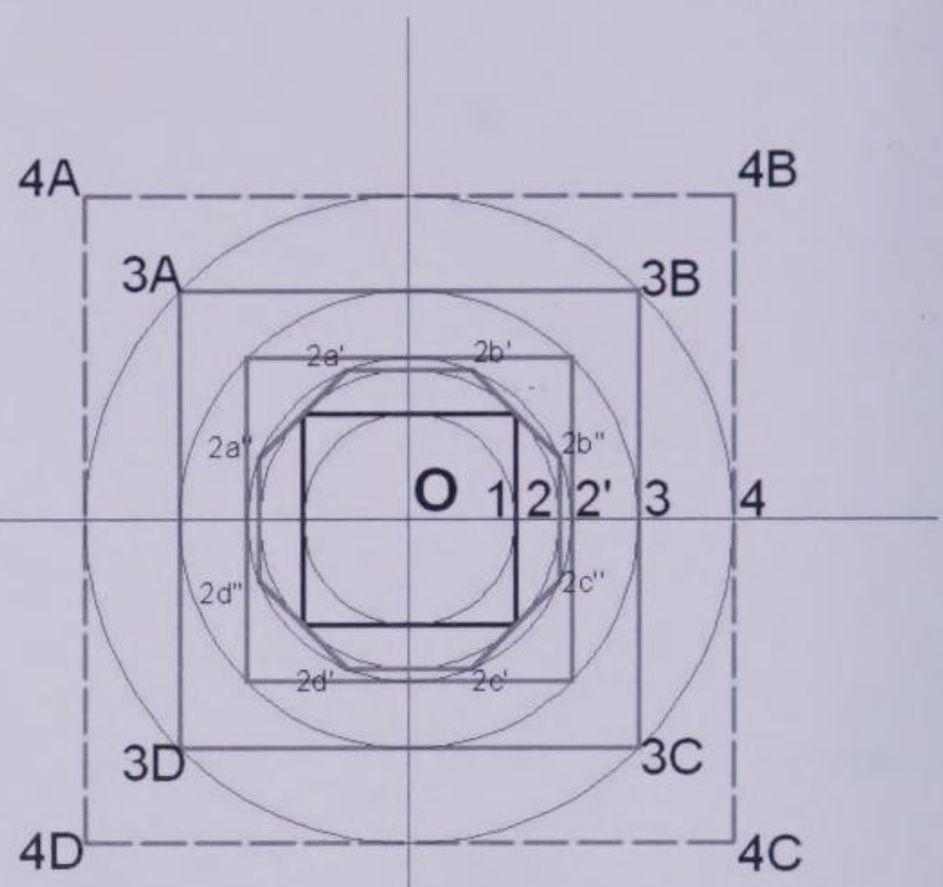
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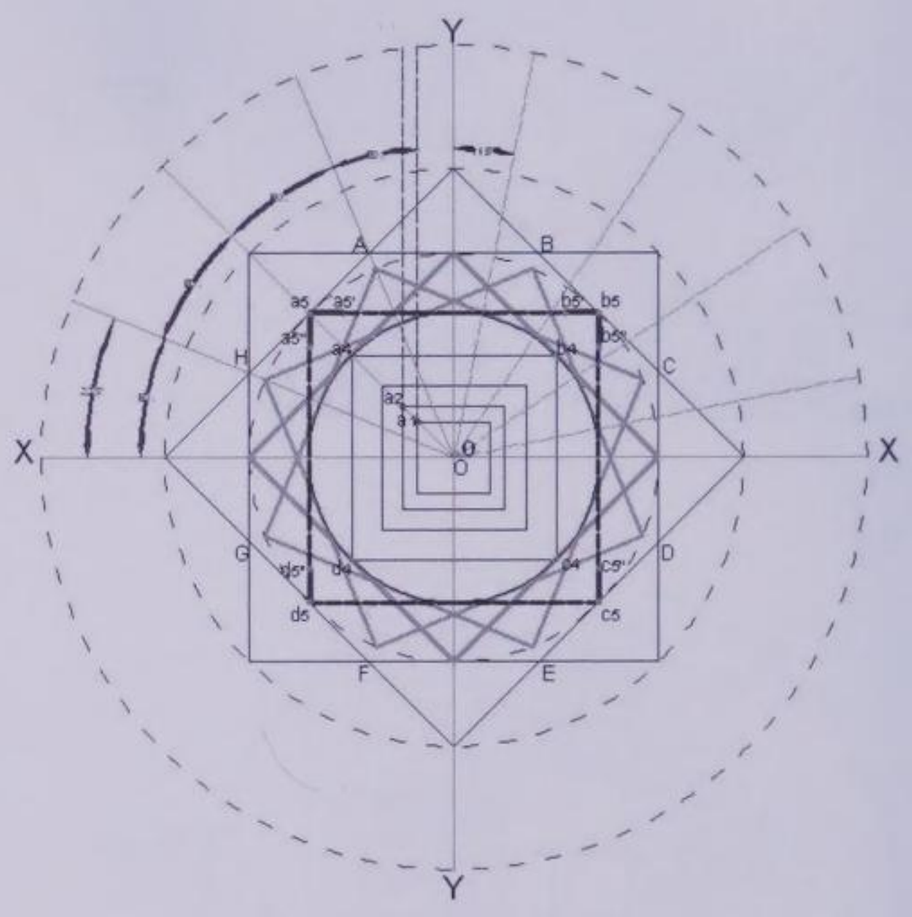
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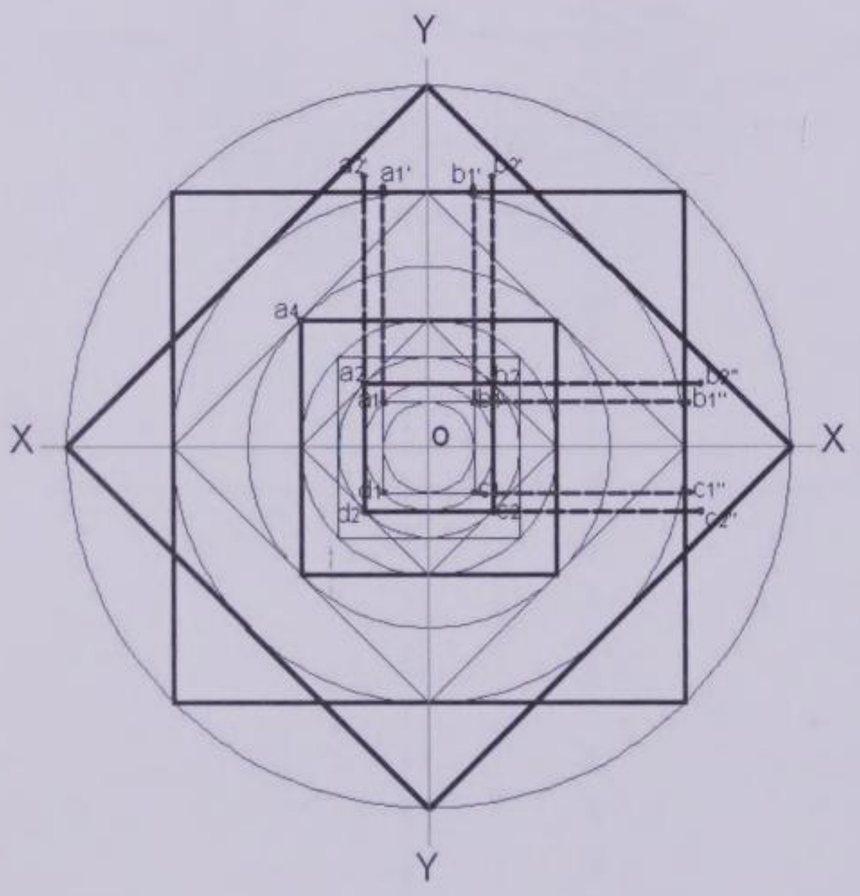
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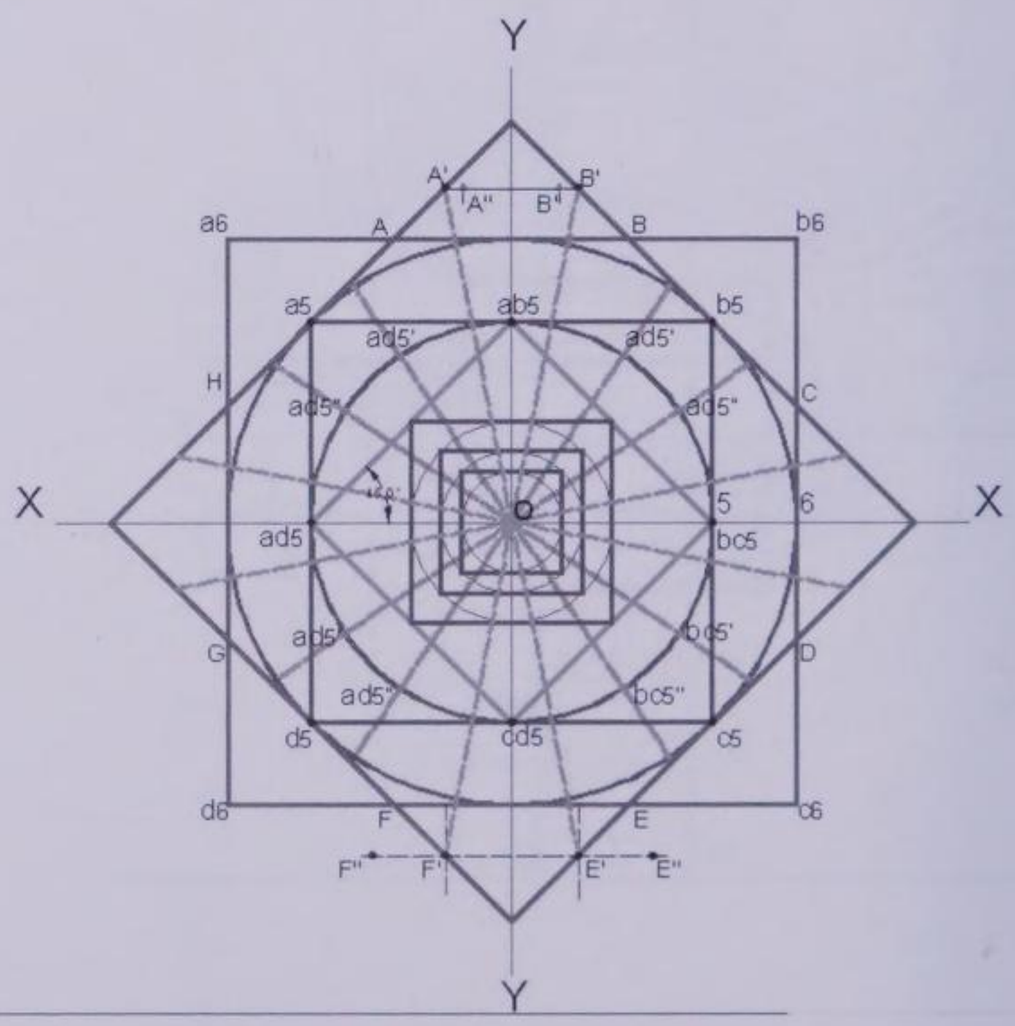
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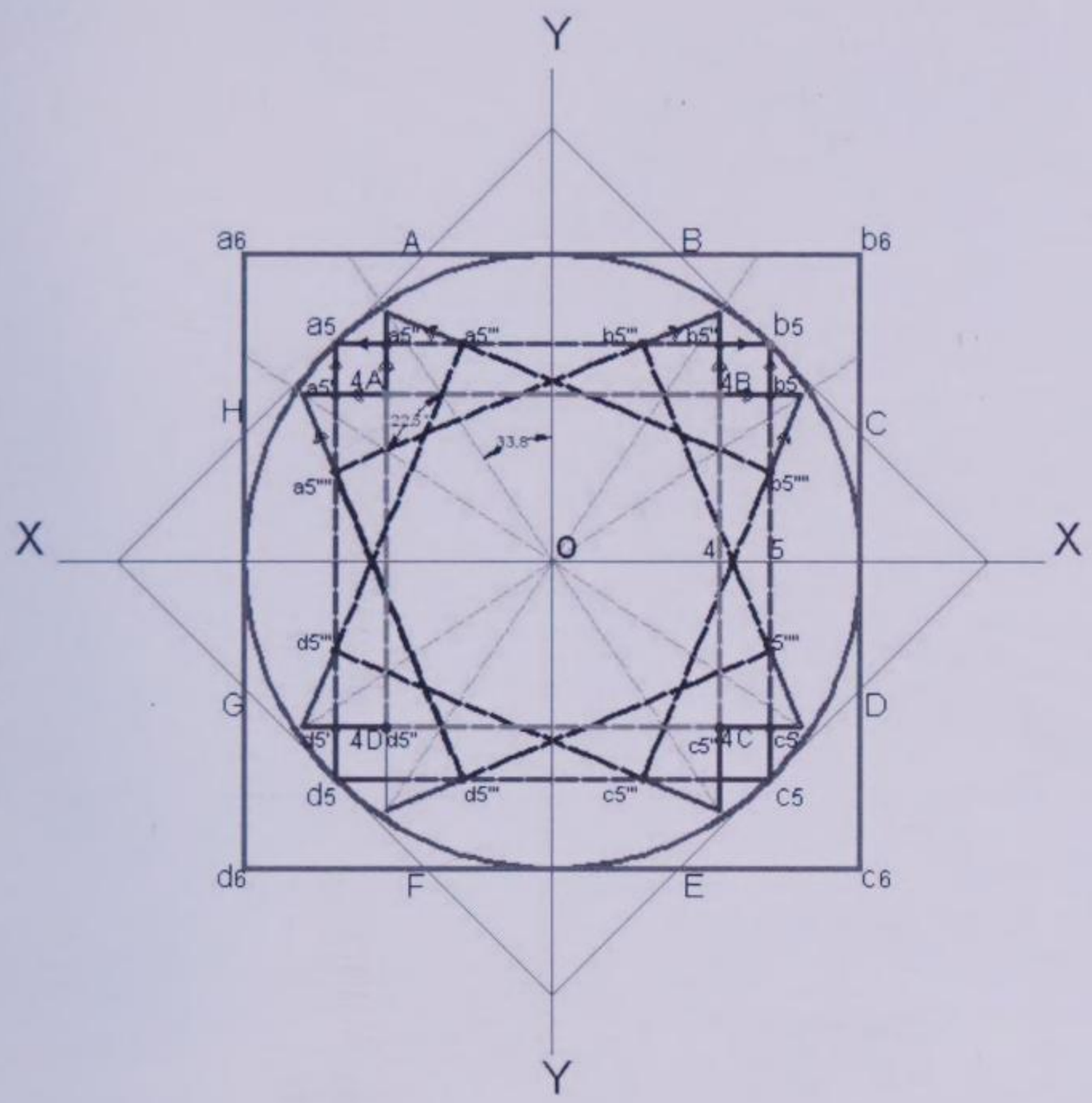
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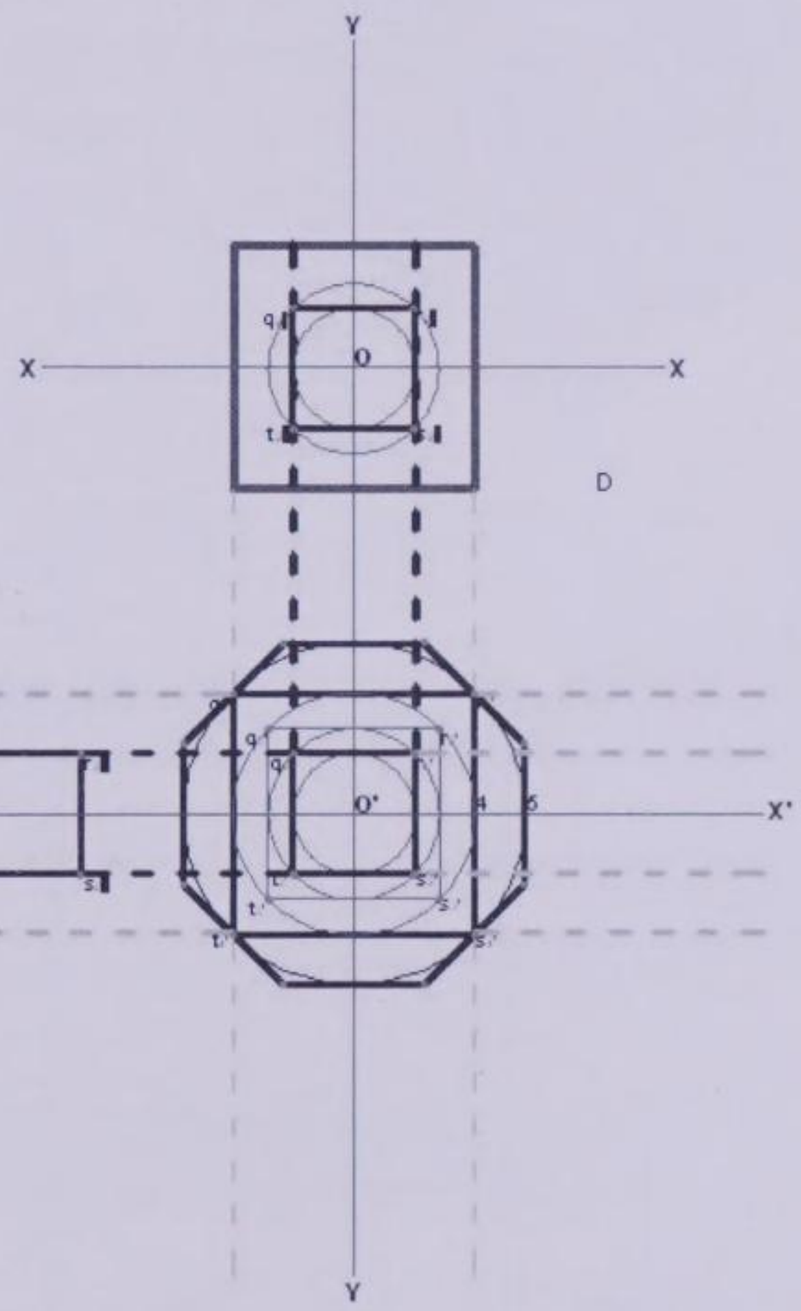
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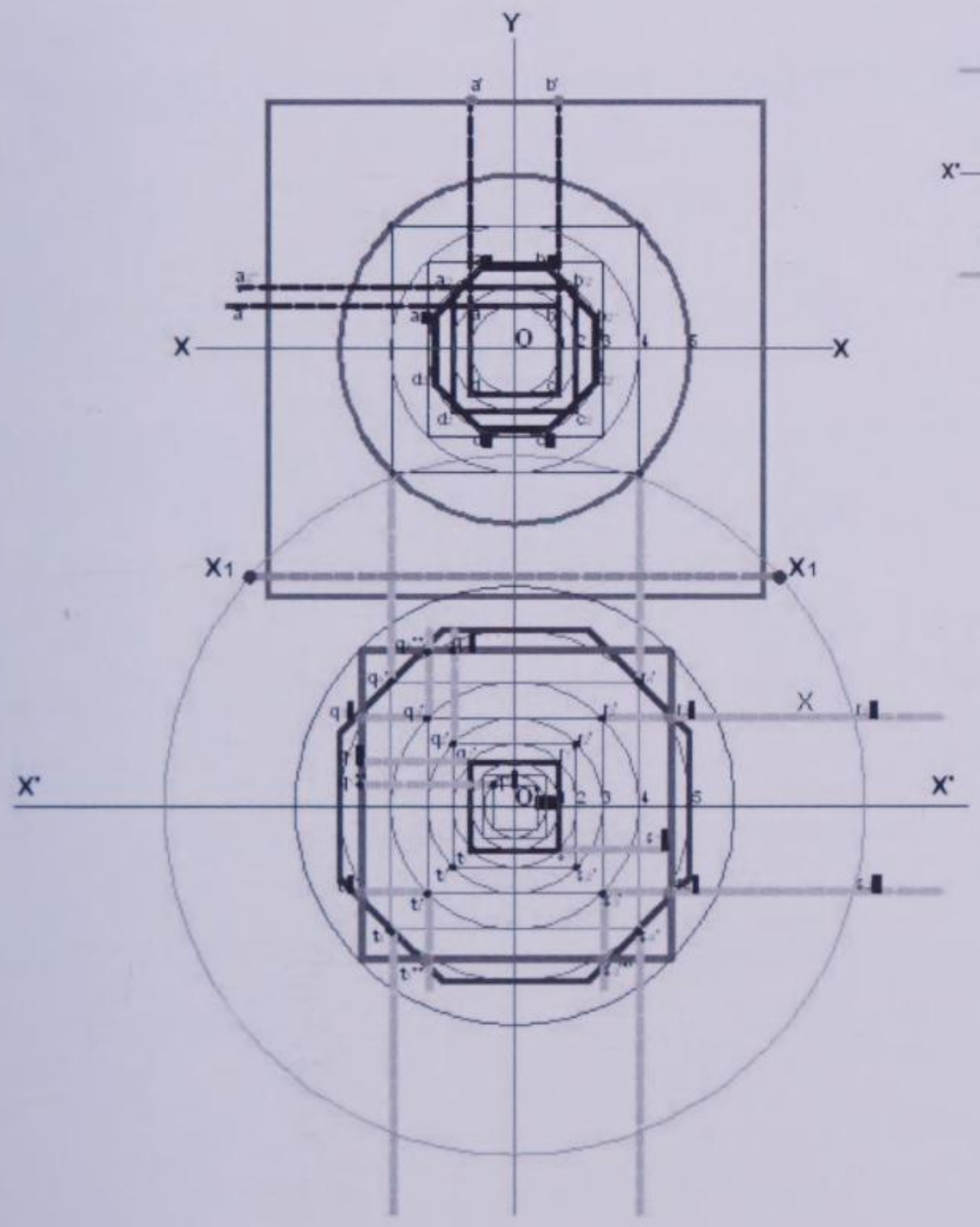
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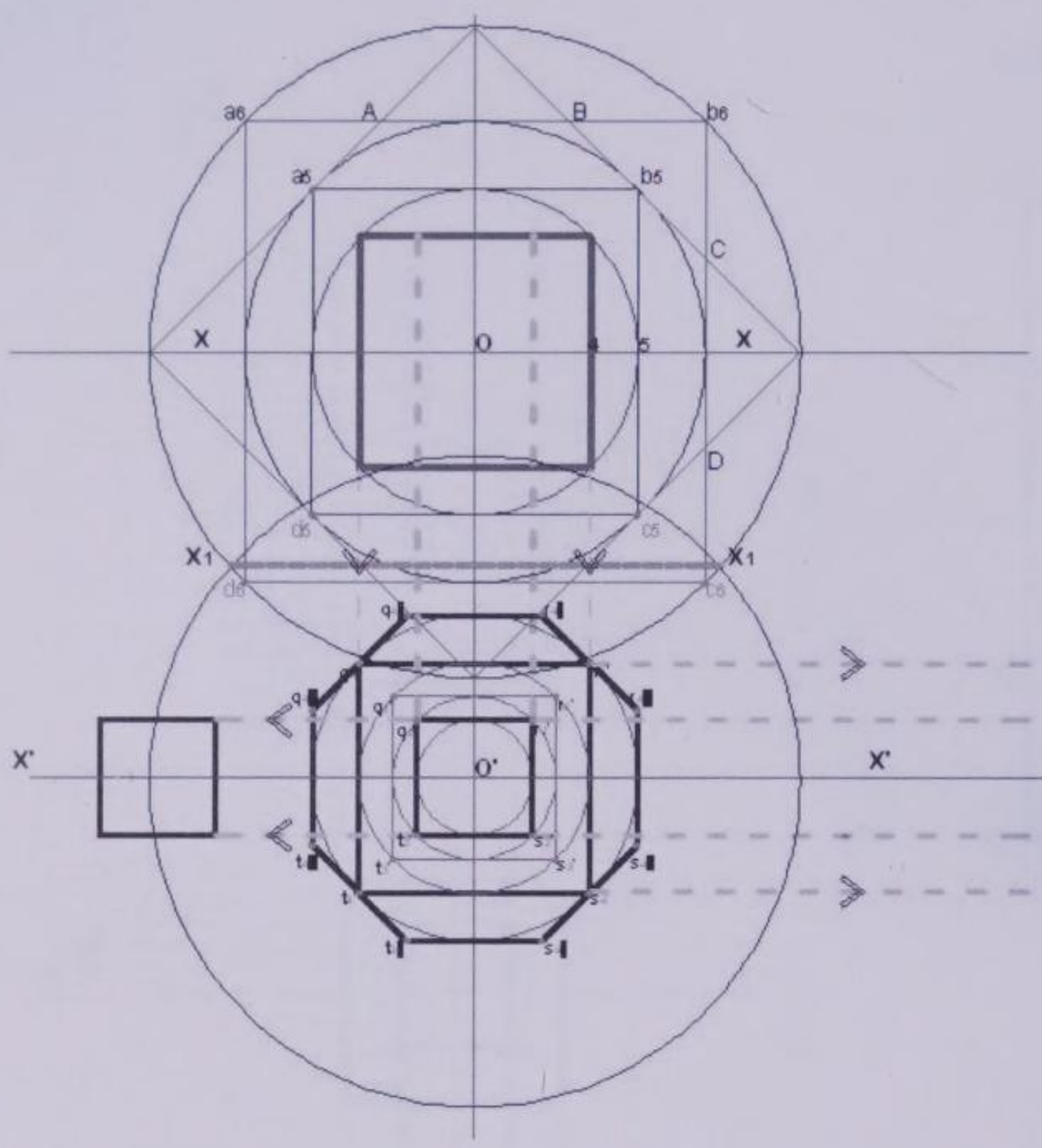
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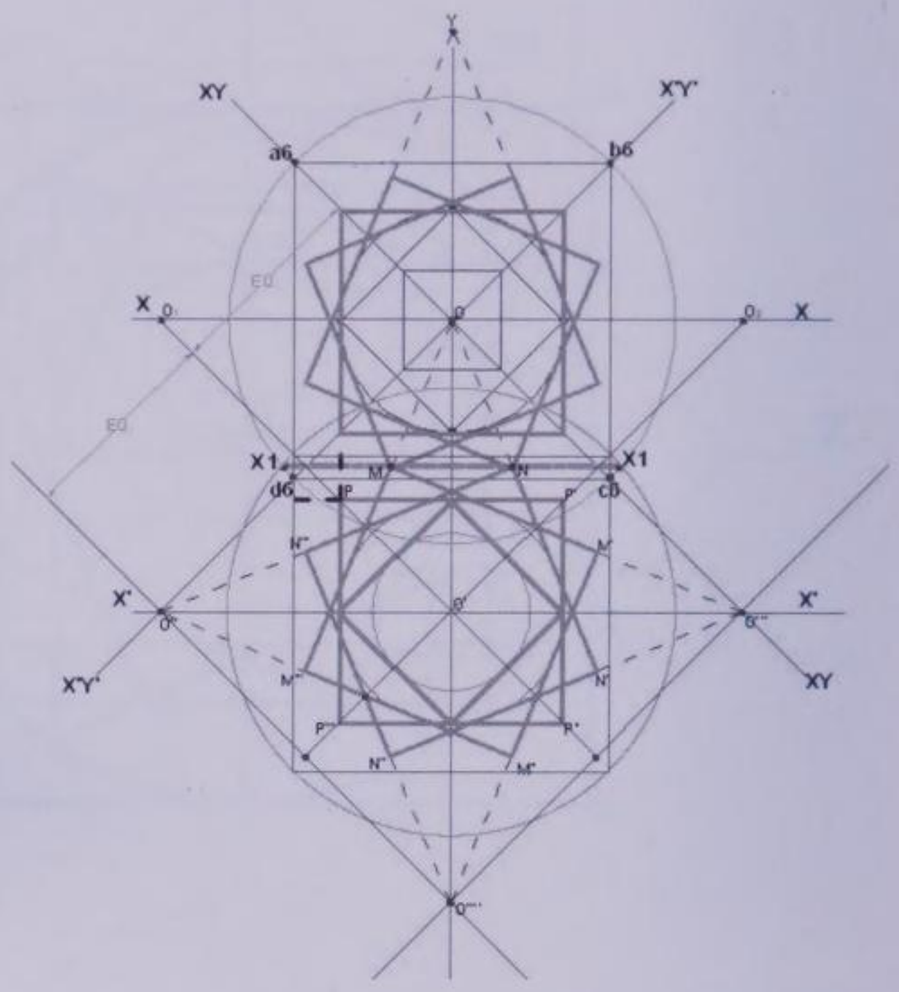
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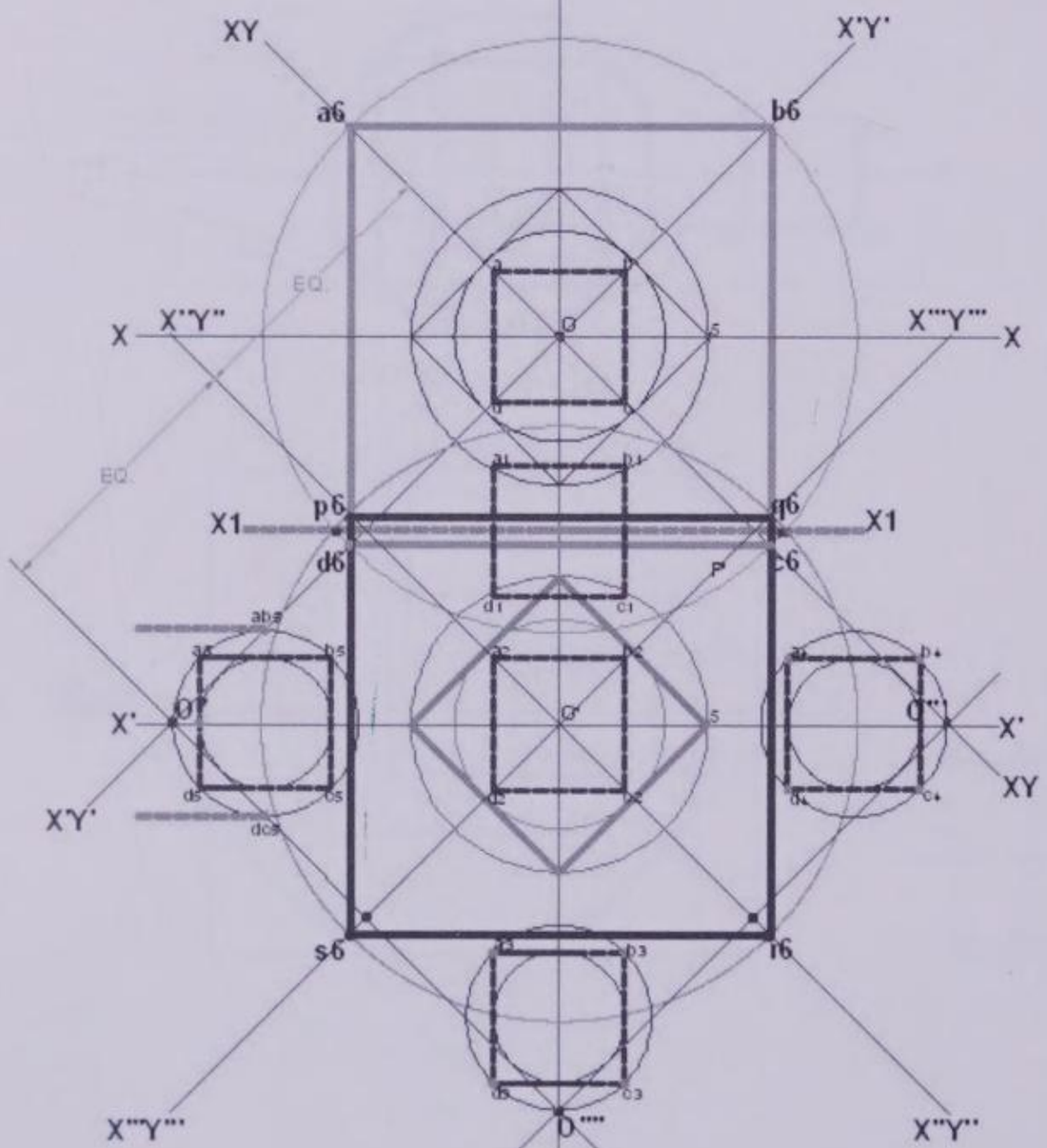
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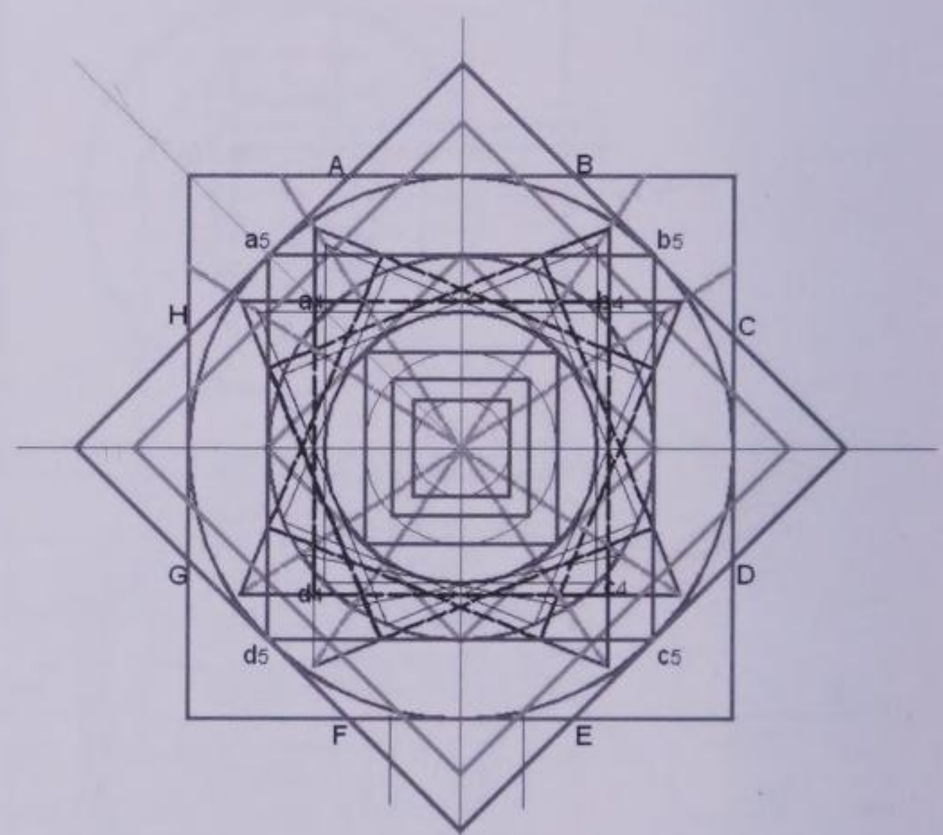
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Brihadeshvara temple, Tanjavur,
Courtesy Gerard Foekema

Gavaksha detail, Nemawar, Madhya Pradesh

Phamsana type, Baleshvara and Lakulisha temples, Jageshvara, Uttaranchal

North east view, Group of temples, Naresar, Madhya Pradesh 8th century

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Glossary

A

Abhayamudra: hand gesture of assurance or protection

Adhisthan: moulded basement (in South India, mouldings below wall-frieze)

Akasalinga: "sky" *linga* placed above crowning *amalaka*

Akasamala: rosary

alamkara-devata: divine figure used as decoration

alinda: aisle

alpanasi: nasi (South India); dormer-window (decorative motif)

amalaka: "myrobolan fruit"; crowning member of Latina. Nagara temples

amalasaraka: Large " cogged wheel" stone crowning North Indian spire (broader than amalaka)

amralaumbi: bunch of mango fruits (decorative motif)

amrta-ghata: crowning vase believed to contain elixir of immortality

anarpita: with detached hara (South India)

anda, andaka: "egg"; spire

andharika: enclosed ambulatory

ariga: principal horizontal or vertical division of temple structure, such as *bhadra, pratiratha, karna*

ankana: bay formed by pillars

ankura: sprout, bud (decorative motif)

antarabhitti: inner wall; sanctum wall

antarala: space in front of sanctum door; vestibule

antarapatta: recess between mouldings

antarasakha: intermediate band of doorframe

ardhamandapa: half-hall articulated with the vimana or mandapa (South India)

ardhapadma: half-lotus (decorative motif)

ardhaparyanka: *lalitasana*; sitting posture with one leg placed on ground and the other folded on seat

ardharatna: half-diamond (decorative motif)

asanapatta: seat-slab

astagraha: eight planets

astamangala: eight auspicious symbols

asthana-mandapa: audience hall

atibhanga: exaggerated flexion

avalokanaka: window-opening

avatara: divine reincarnation

ayagasabha: hall for worship

ayatana: structural unit; shrine

ayudhapurusa: anthropomorphic form of weapon

B

Bahirsakha: *bahyasakha*; outer *sakha*

bahyasakha: outer door-jamb

bakula: flower of *mimnsops elengi*; minute rayed rosette (decorative motif)

bakulamala: garland of "*bakula*" flowers (decorative motif)

balapanjara: garland of "*bakula*" flowers (decorative motif)

balapanjara: miniature front of an apsidal shrine (decorative motif); a chain of such motifs as a vertical recess between outer and inner *latas* of *shikhara*

balipitha: pedestal for oblation

bhadra: central offset (wall division)

bhadragavaka: opening at the central offset; balcony, window

Bhadraka: square, with "*bhadra*"-like central projection (pillar type)

Bhadrapitha: tier; tiered structure

Bhadraratha: central (wall division)

Bhadravalokama: opening at the central offset; window, balcony

Bharana: top support; capital-part (usually fluted)

Bharani: fluted top-part pillar

Bharapatta: beam

Bharaputraka: atlas; *yaksa* figure supporting superstructure

Bharavahaka: atlas; *yaksa* figure supporting superstructure

Bhavana: mansion; shrine

Bhitta: foundation course, substructure

Bhittistabha: pilaster

Bhumi: earth, level; storey

Bhumi-amalaka: corner "cogged wheel" marking the storey of a North Indian spire

Bhumikhanda: segment supporting *bhumi-amalaka*

Bhuta: goblin

Bhutamala: register of goblins

Bhutasakha: door-jamb carved with *bhutas*

Bodhighara: shrine surrounding a Bodhi tree

Bodhimanda: pedestal on which the Buddha received enlightenment

Brahmakanta: tetragonal column-type (South India)

C

Caitya: object that acts as the focus for worship; the term is sometimes used by itself for the hall housing the caitya (*caityagriha*) or for a barrel-vaulted-window motif based on that hall-type (*caitya-gavaksa*)

caitya-gavaksa: dormer-window (decorative motif)

caityagrha: hall of worship

cakra: wheel, discus

cakrapurusa: anthropomorphic form of Visnu's discus

cakravaka: ruddy goose (decorative motif placed on kapota)

camaradharini: fly-whisk bearing female

campaka: flower of *michelia campaka* (decorative motif)

candrasala: dormer-window (decorative motif); open pavilion on upper storey

candrasalika: diminutive *candrasala*

candrasila: lowest step shaped like a "half moon"

candravalokana: ornate window, window for viewing the moon

candrika: architectural member between amalaka and crowning *kalasa*

capa: "bow"; apse

capakara: apsidal

capetamudra: posture of administering a slap

carana: mythical flying ascetic

catuhsakha: having four *sakhas*

caturbhuma: four-storeyed

caturmukha: four-faced, four-doored

caturmukhalinga: four-faced *linga*

catuski: bay of four pillars

catustala: four-storeyed

cauri: fly-whisk

cetiya: *Prakrit* form of *caitya*

cetiyaghara: *Prakrit* form of *caityagriha*

chadya: eave

channavira: ornamental jewelry resembling a cross-brace

chatra: umbrella, a symbol of royalty

chatradharini: umbrella-bearing female

cippika: minor cyma moulding

citra: ornament, image, picture

citra-torana: ornamental *torana*-arch

cula, culika: "hair on crown"; finial, crest

D

Danda: "staff"; pillar-shaft

dandacchadya: straight eave as opposed to khuracchadya (curved eave)

dandika: pillaret

darpana: "mirror"; circular decorative motif

devagrha: "house of a divinity"; shrine

devakostha: niche for a divinity

devakula: shrine

devakulika: minor shrine, peripheral shrine

devalacarani: demigod placed on top of the sikhara (Orissa)

devalaya: temple; shrine

devanikaya: temple of management committee

devasurasangrama: mythical episode of "fight between gods and demons"

Dhnaputra: anthropomorphic form of "mythical treasure"; Nidhiputra

dharanvita: facetted

dharanvita usnisa: facetted coping piece

dharavrta: facetted

dharmacakra: Buddhist "wheel of law"

dhvaja: banner, cognizance

dhvajastambha: banner used as standard

diggajas: four mythical "elephants of the quarters"

Dikpalas: eight guardians of the directions

dimdima: kettle drum

dinara: gold coin (adopted from "denarius")

dipadharini: female lamp-bearer

Dravida: South Indian temple-type

Dravidakuta: spirelet of Dravida type

dvadasadityas: 12 varieties of Sun-god

dvara: door

dvarakosthaka: gate chamber; doorway niche

dvarapala: door-guardian

dvarasakha: band of doorframe ornament; doorjamb

dvarattalaka: gateway with a tall upper storey

dvi-anga: with two planes of offset (*triratha*)

dvibhuma: two-storeyed

dvisakha: having two *sakhas*

E

Eduka: a temple-type resembling a terraced stupa (discussed in *Visnudharmottarapurana*)

ekamukhalinga: *Shivalinga* with one human face

ekandaka: single spired

ekavali: necklace having a single pearl-strand

ekavalli-surasena: foliate pediment with a single large *gavaksha* dormer

ekavalli-surasena: foliate pediment with a single large *gavaksha* dormer

G

Godadevi: anthropomorphic form of Vishnu's mace (female)

gadha: recess of *gavaksha*

gagaraka: decorative motif comprising arrow between two spirals

gagarapatti: a frieze of *gagarakas*

gaja: elephant

gajakranta-simha: lion pouncing on elephant (decorative motif)

gajamunda: elephant's head (decorative motif)

gajapitha: moulding of elephant figures

gajaprsthakrti: shaped after elephant's back

gajatalu: "elephant's palate" (decorative ceiling-course)

gajavyala: *vyala* with elephant head

gala: *kantha*; recessed moulding

galopada: vertical partition in the gala

gana: *bhuta*, *pramatha*; goblin

gananayaka: leader of the *ganas*

ganasakha: *sakha* ornamented with *ganas*

gandharva: celestial minstrel

gandharvamukha: head of *gandharva* (decorative motif)

gandharvasakha: *sakha* ornamented with *gandharvas*

garbhabhitti: sanctum wall

garbhagrha: womb-house; sanctum

garuda: mythical bird

Garuda: Vishnu's vehicle

Garudadhvaja: Garuda-standard; name of Visnu

gavaksa: "cow's-eye" (decorative motif); *candrasala*

gavaksajala: lattice of *gavaksas*

gavaksanasi: *nasi* faced by *gavaksas*

ghanadvara: false door on the central offset

ghanta: bell

ghantamala:

ghata: vase, pot; cushion-shaped pillar-part (above *lasuna*)

Ghata: temple-type discussed in Brhatsamhita and other *silpa* texts

ghatapallava: vase-and-foliage (pillar-type)

godhasana: having "iguana" mount; form of Parvati

gomutrika: wave design (decorative motif)

gonetra: "bull's eye" (jali design)

gopanasi: circular purlin; circular roof-covering

gopurattalakas: city gateway with tall upper storey

graiveyaka: torque

grasa: gorgon or gorgon head

grasakinkinika: jingling bells suspended from *grasamukhas* (decorative motif)

grasamala: chain of grasa motifs

grasamukha: gorgon face or head; *kirttimukha*

grasapattaka: band of *grasa* motifs

grasapatti, grasapattika: band of *grasa* motifs

grhapindi: wall of an upper storey (South India)

grha-stupa: temple hall containing stupa

griva: neck; recess between the *shikhara* and crowning *amalaka*

gudhamandapa: closed hall

H

hamsa: goose, gander (decorative motif)

hamsa-torana: torana-arch adorned with *hamsas*

hamsamala: band of *hamsas*

hamsa-mithuna: pair of geese

hara: garland; balustrade or cloistered parapet (South India)

harmya: pavilion on the sky storey

hastihasta: stairway banister resembling elephant trunk

I

Ihamrga: imaginary animal (decorative motif)

Illikavalana: "convolution of caterpillar"; convoluting pediment

Indusalika: candrasalika (decorative motif)

J

jadyakumbha: lowest pitha moulding resembling "kumha" (pot)

jagati: plinth, platform; basal moulding of adhisthana (South India)

Jahnavi: Ganga

jakkhayatana (Prakrit): yaksa shrine

jala, jalaka: mesh design

jalamala: garland of mesh design

jalavatayana: window carved with mesh design

jali: mesh, lattice, screen; perforated window

jambhaka: goblin

jangha: wall, wall frieze; elevation between *vedibandha* and *shikhara*

jatajuta: arranged mass of matted locks

jatamukuta: crown of matted locks

K

kacchapa: tortoise

kadalikakarana: corbelling (construction technique)

kaksasana: seat-back

kalasa: "pitcher"; torus moulding

kalika: bud (conical decorative motif)

kalpavalli: wish-fulfilling vine

kampa: rectangular fillet (South Indian)

kandabhitti: *garbhabhitti*, sanctum wall

kandhara: broad recess between mouldings

kankanapatra: "serrated leaf" (decorative motif)

kankanapatra-patti: register of kankanapatra design

kantha: neck; recess between mouldings

kantha-patti: frieze in the *kantha*

kapili: wall projecting in front of the sanctum framing a vestibule

kapisirsa, kapisirsaka: parapet

kapota: roll-cornice; overhanging cornice

kapotapali, kapotali: cyma-eave cornice

kapotapalika: cyma-eave cornice

karimakara: fanciful form of crocodile

karna: angle, corner; corner wall-division

karnaka: arris moulding on pillar capital

karnakundala: earring

karnakuta: miniature square structure on corner of superstructure

karnalata: corner band if *shikhara*; *venukosa*

karnamalaka: corner amalaka

karnandaka: corner spirelet

karnapattika: corner frieze

karnaprasada: miniature temple coming at the corner

karnaratha: corner band of the spire (Orissa); *karnalata*, *venukosa*

karnattalaka: corner bastion

karnika: knife-edged arris moulding

kati: "waist"; wall (early synonym for *jangha*)

kautuka: fanciful figure

khalva: plain recess

khalvasakha: plain recessed sakha

khanda: segment (of outer band of curved spire)

kharasila: cap-stone of foundation platform

khattaka: ornate niche

khura: basal moulding of *vedibandha*

khura-kumbha: complex of *khura* and *kumbha* mouldings

khuracchadya: curved eave, awning

kinkinimala: bell-garland

kinnara: celestial musician

kinnarivaktra: face of a divine female minstrel

kiritamukuta: conical crown

kirttimukha: "face of glory"; *grasamukha*

kola: "boar"; decorative ceiling course

kosthika: storeroom

ksudrapadma: minor cyma moulding with lotus-petal pattern

ksudropana: minor sub-plinth course

kudyastambha: pilaster

kumara: atlas; *bharaputraka*

kumbha: "pot"; *vedibandha* moulding

kumbhaka: pillar base

kumbhanda: *gana* with face in the stomach

kumbhika: base of pillaret

kumuda: torus moulding

kunda: tank

kunda: a type of flower

kunjaraksa: a perforated decorative design

Kuta: superstructure-type

kuta: square aedicule; spirelet; *kutagara*

kutagara: a square chamber on the upper storey; square miniature shrine

kutagarasala: rectangular miniature shrine

kutakara: resembling square aedicule

L

Lalata: central part (of door lintel)

lalatabimba (bimba): crest figure, central symbol on door lintel

lambana: "falling down"; depending ornament (decorative motif)

lasuna: vase-shaped part of pillar capital

lata: creeper; vertical band of *shikhara*

Latina: North Indian *shikhara*-type with curved vertical bands (*latas*)

linga: Siva's phallic pillar

lingakara: *linga*-shaped shrine-type described in early *silpa* texts

lingapitha: base of *linga*; *pithika*

lokapala: guardian of one of the four principal quarters

M

Madhyabandha: middle band

Madhyalata: central band of Latina *shikhara*

Madhyasakha: central *sakha* of the door

Madhyasala: central hall

Mahadvara: principal gate

Mahakala: *Shaiva dvarapala*

Mahanasi: Large gavaksa dormer (South India)

mahapatta, mahapatti, mahapattika: broad band

Maharajalilasana: "royal" sitting posture

mahavindra: eminent Buddhist monastery

makara: crocodile-monster; dolphin

makara-pranala: *makara*-shaped gargoyle

makara-torana: *torana*-arch emanating from *makaras*

makara-vahini: goddess riding on a *makara*; Ganga

mala: garland; decorative band

mala-vidyadhara: flying celestial figure carrying garland

maladhara: garland-bearing

malapattika: garland-frieze

malasakha: *sakha* in the form of a *mala*

malsthana: pillar-part below capital decorated with floral festoons

manasutra: straight line marked by a measuring cord

manca: dais

mancipa: dais-like moulding supporting figures

mandala: diagram

mandapa: hall, generally with columns

mandapika: diminutive of *mandapa*; temple-type with pillared walls and usually

mandaraka: projecting central part of ornate threshold

mandovara: temple structure above *jagati* and below *chadya; kati;* wall

mangalakalasa: *vase and foliage; auspicious vase*

manibandha: band of diamonds alternating with rosettes (decorative motif)

manipadaka: jeweled pendant

manipatti, manipattika: band of jewels (decorative motif)

manjari: spirelet

masuraka: "lentil"; cushion-shaped moulding

matha: monastery

matrka: mother-goddess

mattavarana: *kaksasana*: seat-back ornamented with *vedika* pattern and often with elephant head design at the *base*

mayura: peacock

medhi: basement terrace of stupa

mesavyala: monster with the head if a ram

Misraka: "mixed"; pillar-type combing various forms form square to circular

mithuna: auspicious couple

mithunasakha: *sakha* bearing couples (sometimes erotic)

mukhacatuski: four-pillared entry porch

mukhalinda: front aisle

mukhamandapa: front hall; entry hall

mukhapatti: front of ornate frame

muktadama: pearl festoon (decorative motif)

muktagrasa: grasamukha spewing pearls

muktapuspa-pattika: frieze of flowers fringed with pearls

mukula, mukulika: floral bud (decorative motif)

mukuta: crown, tiara

mulamanjari: principal *shikhara*

mulanayaka: main enshrined deity

mulaprasada: main shrine; shrine proper

mundamala: garland of skulls (decorative motif)

Mundamala: flat-roofed temple-type

musala: threshing staff, grain-pounder

N

Nabhicchanda: type of ornate ceiling with deep concentric bands

naga: cobra; snake

nagapasa: design of intertwined serpents

Nagara: generic name for North Indian temple-type

Nagaraja: anthropomorphic cobra-king

nagasakha: *sakha* with *naga* pattern

nagi, nagini: female serpent

nakula, nakulaka: a type of purse

Nandi (Nandin, Nandi): Siva's bull

Nandi: name of *Shaiva dvarapala*

Nandi-mandapa: pavilion for Shiva's bull

nasi: gable-end of a wagon – vault; *gavaksha* or "*caitya*-arch" motif (South India)

navabhuma: nine-Storeyed

Navagrahas: nine planets

navandaka: having nine spires

navanidhis: nine mythical treasures

nidhi: mythical treasure

nidhighata: treasure-vase

nidhikalasa: treasure-vase

nidhiputra: anthropomorphic form of "mythical treasure"

nirandhara: without ambulatory

P

Padma: lotus

Padmabharana: lotus-capital

padmadala: lotus petal

padmalata: lotus vine

padmapatra: lotus foliage, lotus leaf

padmapattika: lotus frieze

padmasila: lotus pendant of ceiling

padmatapatra: lotus umbrella

padmavalli: lotus vine, same as *padmalata*

padmopana: lotus-formed *upana* (South India)

pancabhuma: five-storeyed

pancadevopasana: worship of five divinities: Vishnu, Shiva, Surya, Ganapati and Sakti

pancandaka: five-spired

pancaratha: with five offsets *(tri-anga)*

pancasakha: having five *sakhas*

pancatala: five-storeyed

pancayatana: five-shrined

panjara: front of apsidal shrine (decorative motif); central band of Latina *shikhara* (in later texts)

pankti: register

parasu: axe

paricarika: female attendant

parikara: image-frame, retinue on image-frame

parikarma: niche frame

parikha: moat

parivaradevatas: surrounding divinities placed on temple wall

parnapatti: band of foliage

parsada: courtier; *gana*

parsvadevata: attendant divinity (in Orissa, a synonym for *parivaradevata*)

patra: leaf, foliage

patralata: leafy scroll

patrasakha: *sakha* adorned with foliage

patravalli: patralata, leafy scroll

patta, patti: band, register

pattika: kampa; rectilinear fillet (South India)

pedya: lower block of door-jambs (often carved with figures of river-goddesses and door guardians)

pedyapinda: unworked lower section of door-jamb

phalaka: abacus (pillar-part supporting potika)

phalana: minor offset demarcating planes

phamsakara: having pyramidal tiered form

phamsakuta: pyramidal tiered aedicula

Phamsana: tiered, pyramidal roof-type

phamsana (phamsana): "wedge"; tier of pyramidal roof-type

pidhanaphalaka: covering slab of *shikhara*

pitha: pedestal, platform

pithika: image pedestal

potika: bracket-capital

prabhamandala: aureole

prabhavali: nimbus, halo

pradaksina: circumambulation

pradaksinapatha: circumambulatory path

praggriva: projection in front of sanctum; wall of such a projection

prakara: walled enclosure

pramatha: gana

pranala: sacred drain; water chute

rasada: "palace, mansion"; temple

prastara: entablature

pratibhadra: offset flanking *bhadra*

pratihara: attendant, door-guardian

pratihari: female door-guardian

pratikarna: offset flanking karma

pratilata: flanking vertical band of *shikhara*

pratima: image

pratiratha: wall-offset flanking *bhadra*

pratirupaka: dramatic figure-composition

pratoli: gatehouse

preksagara: theatre

punyasala: almshouse

purnaghata: vase-of-plenty (decorative motif)

purnakalasa: vase-of-plenty (decorative motif)

purnakumbha: vase-of-plenty (decorative motif)

puspa: flower

puspa-torana: floral festoon

puspadhara: floral-bearing male

puspadhari: flower-bearing female

Puspakhanda: flower-segment (*Jali* design)

puspapatti, puspapattika: floral band

pusparatna: floral diamond (decorative motif)

puspavalli: floral diamond (decorative motif)

R

Raja nivesana: royal residence

raja prasada: royal palace

rajasenaka: broad ornate fillet as substructure of *kaksasana* (usually decorated with diamond and double volute pattern)

ramanaka: pavilion on landing platform

rangamandapa: open-type of pillared hall; *nrtyamandapa*

ratha: "chariot"; wall division; central vertical band of *shikhara* ("*raha*" in orissa)

rathika: framed niche

ratikrida: erotic depiction

ratnapatta, ratnapatti: band of diamond pattern

ratnasakha: *sakha* with jewel pattern

rekha: curvature (of *shikhara*)

rekhasikhara: curved spire

rekhasutra: measure of curvature of *shikhara*

Rucaka: square pillar-type

Rudrakanta: round column-type (South India)

rupa: figural ornament

rupakantha: recess carved with figures

rupasakha: sakha with figure-ornament

rupastambha: pillar-pilaster carved with figures

S

Sabha: rectangular hall

sabhakara: rectangular vaulted roof without gables

sabhamandapa: open type of pillared hall

sadatala: *six*-storeyed

sakha: decorative door-band; door-jamb

sakha-vibhakti: division of doorframe into bands

sala: rectangular chamber

sala-sikhara: wagon-vault roof; *Valabhi*

salabhanjika: woman entwining a tree (decorative motif)

salaka: grille

salakara: vaulted roof with gables ends; *Valabhi*

salilantara: recess between wall-bays

salmali: silk-cotton tree or its blossom

samabhanga: standing posture in equipoise

Samatala: flat ceiling-type

samatala: flat

sandhara: with ambulatory

sanghati: monk's robe

sankha: conch shell

sankhanidhi: treasure flowing from conch

Sankhapurusa: anthropomorphic form of Vishnu's conch

saptabhuma: seven-storeyed

saptakhanda rekha: curvature of seven segments

Saptamatrkas: Seven Mothers

saptatala: seven-storeyed

sardula: lion-monster

sarvatobhadra: temple-type with four openings

sarvatobhadrika: four-faced image

satkhanda rekha: curvature of six segments

sattra: free feeding-house

saubhagyappatta: frieze depicting Laksmi

siddha: celestial ascetic

sikha: pinnacle, crest

sikhara: tower, spire (North India): crowing dome (South India)

sikharika: minor spire

simhakarna: single *candrasala* pediment

simhamukha: lion's head

simhapanjara: bay-window projecting form an upper storey

simhavaktra: lion's head

simhavyala: lion's head

sirsa, sirsaka: pillar bracket

skandha: shoulder moulding; flat upper platform of sikhara

skandha-vedi: lower profile of a *Valabhi* roof

sobhapattika: ornamented frieze; carved band

sopana: steps

sopanamala: series of steps

srivrksa: distinctively detailed vertical foliage pattern (decorative motif)

srivrksasakha: *sakha* carved with *srivrksa* pattern

sringa: spirelet

stambhajalaka: grille made up of pillarets

stambhasakha: *sakha* in the form of a pillar

stana: sacred area

stupa: solid hemispherical tumulus

subhadra: central offset of either ratha or lata

sukanasa, sukanasika: antefix above the roof of the kapili

suparna: goose (decorative motif)

suparna-mithuna: pair of suparnas

surasena, surasenaka: pediment made up of *caitya*-dormers (*candrasalas*)

surpa: tier resembling pent-roof

surpacchadya: broad pent-roof

surpakara: surpa-shaped

T

Tala: storey

talapatra: palm-leaf

tamala, tamalapatra: leaf of xanthochymus pictorius (decorative motif)

tankitamanca: carved dais

taranga: wave (bracket-type)

taranga-potika: pillar-bracket adorned with "wave" design

tati, tatita: minor dish-moulding over *lasuna*

thakara: minor *caitya*-dormer; *candrasalika*

tilaka: minor niche with *samvarana* roof

tirtha: sacred spot (near water)

torana-prasada: mansion pattern on gateway

tri-anga: with three planes of offsets

tribhanga: triple bend of human figure

tribhuma: three-storeyed

trigunasutra: three-fold cord (delineation of sikhara's curvature)

trikhanda rekha: curvature of three segments

tripatta kumuda: *kumuda* moulding with three facets

triratha: with three projections

trisakha: with three projections

trisula: trident

Trisulapurusa: anthropomorphic form of Siva's trisula

tritala: three-storeyed

trivali-surasena: foliate pediment of three parts

tula: joist, joist-end

tulapitha: frieze of joist-ends

tulasangraha: series of joist-ends

U

Uccalaka: attic pillar

Udadhikumara: minor divinity allied to Varuna

udgama: pediment of interconnected *caitya*-dormers [candrasalas]

udumbara: threshold

upabhadra: minor offset flanking but forming part of the central offset

upana: sub-plinth moulding

upapitha: substructure of pitha

uparitala: sky storey, upper storey

urdhvakampa: upper fillet moulding (South India)

urdhvapadma: inverted cyma-recta with lotus-petal pattern

usnisa: coping

utkutikasana: posture of sitting on haunches

utpala: blue lotus; water lily

uttara: architrave of the entablature (South India)

uttaranga: architrave of the entablature; lintel, beam

uttaravedi: *vedi* on upper part of superstructure; crowning slab of curvilinear *shikhara*; *skandha*

V

Vahana: mount

vajan, vajanapatti, vajanapattika: projecting upper band (South India)

Vajra: thunderbolt (as weapon)

Vajrasana: adamantine seat

Valabhi: temple-type with *sala-sikhara*

Valabhicchonda: belonging to *Valabhi* temple-type

valika: curved rafter

valli(valli): creeper, scroll (decorative motif)

vanamala: long garland worn by Vishnu

vandanamala, vandanamalika: festoon of garlands (decorative motif)

vapi: step-well; tank

varandika: moulded parapet; elevational element separating *jangha* from *shikhara*

vasantapattika: broad band carved with floral scroll

Vastumandala: sacred diagram on which a structure is founded

vatapana: window

vatayana: window

vedi: altar

vedibandha: basal wall-moulding, consisting primarily of *khura, kumbha, kalasha, antarapatta* and *kapotapali*

vedika: railing, balustrade

venukosa: "bamboo-nodes"; outer nodal sheath of curvilinear spire

vetra: narrow recessed moulding; gala

vidyahara: Flying celestial figure

vihara: Monastery (sometimes with sanctum)

vijapuraka: pear-shaped citrus used as a pitcher-stopper

vikarna: intermediate direction

vimana: main temple-structure

vimana-vedika: *vedika* below the *stupi* (South India)

vimanakara: resembling South Indian temple-type

Visnucchanda sikhara: octagonal *shikhara*-type (South India)

vitana: ceiling

vitardi: *vedika*

vithi, vithika: gallery

vrtta: circular

vrttakarna: ovolo-shaped moulding below kapota

vrttakumuda: kalasa moulding

vrttapattika: minor roll-moulding

vrttasphutita: round pillaret with pot base and nasika top (decorative motif) (South India)

vrttayata: elliptical

vyakhyanamudra: hand-posture of exposition

vyala: composite fantastic animal

vyalapatti: register of *vyalas*

vyalasakha: *sakha* decorated with *vyalas*

vyalavari: register of *vyalas*

Y

Yaksa: a class of demigods with benevolent as well as malevolent aspects

yaksi, yaksini: female *yaksa*

yasti: staff

yogapatta: scarf tied round the knees to assist in the practice of yoga

List of Figures

Chapter 1: Introduction

Figure 1.1: Siva temple, Group 4, Kadwaha, Madhya Pradesh

(Page: 22)

Figure 1.2: Chart on Proportions of temple's key elements on plan and elevation. Based on Stella Kramrisch, 'Proportionate Measurement and Varieties of the Temple' in The Hindu Temple 6th edn, vol.1, 2 vols (New Delhi, Motilal Banarsidass, 1996), pp. 227-270.

(Page: 29)

Figure 1.3: The construction of the proposed analytical and design method termed 'Square-Circle-Sequence' (SCS).

(Page: 29)

Figure 1.4: Application of SCS shown for South-west shrine, Kunda-vapi, Dedadara, Gujarat, ca. A.D. 925.

(Page: 30)

Figure 1.5: Relationship being established between the nandi-mandapa and the surrounding structures with the application of SCS at Brihadeshwara temple complex, Tanjavur, ca. A.D. eleventh century.

(Page: 31)

Figure 1.6: Relationship being established between the prasada, mandapa and subsidiary shrine in this five shrined (panchayatana) plan complex. The 'line of union' which is formed at the intersection of the two SCS is also shown at Brahmeshwara temple complex, Bhubaneshwar, Orissa, ca. A.D. 1060.

(Page: 32)

Figure 1.7 : The derivation of the locations of the Kunda and peripheral wall, by the use of projections from the SCS of the South-west shrine, Kunda-vapi, Dedadara, Gujarat, ca. A.D. 925.

(Page: 32)

Figure 1.8 : Figure: 1.8 The locations of the subsidiary shrines (devakulikas) in the larger temple complexes can be established with the use of the SCS method. Photograph of panchayatna temple, Jasmalnath Mahadeva, Asoda, Gujarat, ca. A.D. 1126-1150, view from west, (courtesy AIIS)

(Page: 34)

Figure 1.9: Location of the offsets and projections in the entrance being derived from the SCS of mandapa. Brahmeshwara temple complex, Bhubaneshwar, Orissa, ca. A.D. 1060.

(Page: 34)

Figure 1.10: Analytical drawing of the Sri Yantra showing its intersecting circles. The Sri Yantra, drafted and made suitable for analytical purposes.

(Page: 34)

Figure 1.11: "Sri Yantra, the most celebrated of all the tantric yantras. A mystical construction of the cosmos, the Sri yantra is formed by the interpretation of two sets of triangles, apex upwards, representing the male principle and five, apex downward, representing the female principle. The yantra is devised to give a vision of the totality, so that theadapt may internalize its symbols for the ultimate realization of his unity with the cosmos." [courtesy Madhu Khanna, 'Archetypal Space and Sacred Sound', in Yantra: The Tantric Symbol of Cosmic Unity, 2nd edn (London, Thames and Hudson, 2003), p.113, Fig.62]

(Page: 35)

Figure 1.12: Application of the Sri Yantra on temple plan, Bahu temple, Nagada, Rajasthan ca. A.D. 975-980. Note the locations of the base of the female principle matches with the inner wall of the garbhagriha and the apex of the male principle matches with the centre of the garbhagriha.

(Page: 35)

Figure 1.13: Application of the Sri yantra to the elevation, Vishnu temple, Aithor, Gujarat, c. A.D. early eleventh century.

(Page: 35)

Figure 1.14: Diagram establishing the relationship between plan elements and showing similar sizes, stellate temple, Jagadamba Devi, Kokamtham, Maharastra, ca. A.D. Fourteenth century.

(Page: 35)

Figure 1.15: Similar representation of plan elements as shown by Boner, (courtesy Alice Boner, 'Extracts from the Silpasarini', in Studies in Indian Temple Architecture, ed. by Pramod Chandra, (New Delhi, American Institute of Indian Studies, 1975), pp.57-79.

(Page: 36)

Figure 1.16: Area of the plan matches the SCS of square.

(Page: 36)

Figure 1.17: Proportions of the plan, translated on to the elevation façade. Various levels can be determined through the SCS, Vishnu temple, Aithor, Gujarat, c. A.D. early eleventh.

(Page: 36)

Figure 1.18: SCS determining the pillar positions inside the sanctum, Vishnu temple, Batasha, Madhya Pradesh, ca. A.D. tenth century.

(Page: 36)

Figure 11.19: All the inverted ceiling plans being worked out from SCS. The shift is visible in the ceiling which is created by an inscribed octagon, Chennakesva temple, Nagalpura, Karnataka, ca. A.D. 1200.

(Page: 37)

Figure 1.20: The kutastambha being derived from the smallest SC sequence. The diagonal lines of the stambhas match with the garbhagriha corners and center points. Bahu temple, Rajasthan.

(Page: 36)

Figure 1.21: Locations of horizontal divisions on the elevation, Bahu temple, Rajasthan.

(Page: 37)

Figure 1.22: Palm leaf inscriptions showing the prasada and the yantra, date not known (courtesy Andreas Volwahesen, Living Architecture: Indian, (New York, Grosset & Dunlap, 1969), p.54.

(Page: 37)

Figure 1.23: The curvature of the temple being derived from the plan. Location of the base and shoulder course (skandha) of the spire is related to the plan proportions. Jaina temple, Baunpur, Madhya Pradesh, ca. A.D. 900-925.

(Page: 40)

Figure 1.24: Roof plan being generated with the help of plan and elevation. Eastern Devakulika, Sacciyamata temple, Osian, ca. A.D. 1178.

(Page: 40)

Figure 1.25: Projections from the elevation and a use of a grid are helpful in creating complex 'Shekhari' temple plans. Ambika temple, Jagat, Udaipur, Rajasthan, ca. A.D. 961.

(Page: 40)

Figure 1.26: Computer modelling of Sringa

(Page: 40)

Figure 1.27: Location of the spirelets (sringas), Roof plan of Lakshmana temple, Khajuraho

(Page: 41)

Figure 1.28: Roof plan of Kandhariya Mahadeva temple, Khajuraho, Madhya Pradesh, ca. A.D. 1030.

(Page: 41)

Figure 1.29: Detailed measured drawings are another application of computer in Ancient Architecture Studies, Measured drawing of Lakshmana temple, Khajuraho included in this study.

(Page: 44)

Figure 1.30: Development of the inverted ceiling plan of Mahamandapa using computers. Kandhariya Mahadeva temple, Khajuraho.

(Page: 44)

Figure 1.31: Model of the crowning member, left: top view, right: 3-D model. Lakshmana temple, Khajuraho, prasada.

(Page: 44)

Figure 1.32: The 3-D model will consist of individual development of sub-parts. Development of 'udgama', Lakshmana temple, Khajuraho.

(Page: 44)

Figure 1.33: Model development of temple transepts, Lakshmana temple, Khajuraho

(Page: 44)

Figure 1.34: The model of the principal spire form, Lakshmana temple, Khajuraho.

(Page: 45)

Figure 1.35: The model of the cluster of spires will involve individual scaled models of the principal spire and its smaller components, Development of the prasada roof form for Lakshmana temple, Khajuraho

(Page: 45)

Figure 1.36: Assembly of subparts of the model. Showing spire and siprelet locations in 3 – Dimensional space, transepts of the temple prasada in correct locations, for Lakshmana temple, Khajuraho.

(Page: 45)

Figure 1.37: Part 3-D model of the prasada, Lakshmana temple, Khajuraho.

(Page: 45)

Figure 1.38: Computer a useful tool to study the complex forms of the inverted ceiling of the temples, Part top view with working drawing, Lakshmana temple, Khajuraho.

(Page: 48)

Figure 1.39: Inverted ceiling of the temples, part inside view, Lakshmana temple, Khajuraho.

(Page: 48)

Figure 1.40: Top view, Inverted ceiling of the temples, part inside view, Lakshmana temple, Khajuraho.

(Page: 48)

Chapter 2: Analysis of Symbolism

Figure 2.1: *Vastupurusha* in the *Mandala* & *Vastu Mandala*

(Page: 50)

Figure 2.2: Gnomon method

(Page: 51)

Figure 2.3: The five elements in an ascending order (Earth, Water, Fire, Air and Ether) are the manifested energies of the sphere of earth (one of the eight Vasus) whose active principle is Fire (also one of the eight Vasus)

(Page: 52)

Figure 2.4: Fire Altar, central part of the fifth layer of the Agni of the Soma Sacrifice (courtesy Vatsyayan, 1997, p. 26)

(Page: 53)

Figure 2.5: Danielou Alain, 'The Thirty-Three Gods' in *Hindu Polytheism*, (London, Routledge & Kegan Paul, 1964), p. 83

(Page: 54)

Figure 2.6: Fire Altar having interlocking 360 circular patterns represents the space where each brick from a total number of 360 represent a day (time). Central part of the fifth layer of the Agni of the Soma Sacrifice (courtesy Vatsyayan, 1997, p. 26)

(Page: 55)

Chapter 3: Development of the 'Square-Circle-Sequence' Diagram & Its Governing Principles

Figure 3.1: Construction method of SCS

(Page: 58)

Figure 3.2: Roriczer's diagram, courtesy Sonit Bafna, 'On the Idea of the Mandala as a Governing Device in Indian Architectural Tradition', in JSAH / 59:1, (March, 2000)

(Page: 59)

Figure 3.3: Analysis of Roriczer's diagram

(Page: 59)

Figure 3.6: Chart of the twelve zodiacal divisions in relation to ritual. Rajasthan, ca. eighteenth century, Ink and colour on paper. (courtesy Ajit Mookerjee Ritual Art of India, 1998, p.32)

(Page: 61)

Figure 3.4: Step1 of the Square and the Circle Sequence (SCS).

(Page: 63)

Figure 3.5: Step 2 of the Square and the Circle Sequence

(Page: 63)

Figure3.6: Relation ship of the Square-Circle-Sequence to the grid: Alternate squares of the SCS viz., the first, third and fifth square matches with the orthogonal grid

(Page: 63)

Figure 3.7: Measurements of circles in the Square and the Circle Sequence (SCS).

(Page: 63)

Figure 3.8: Ratios between expanding squares of SCS

(Page: 64)

Figure 3.9: Ratios (1: 1.1 : 1.2 : 1.4) between the first (1), second square (1.4) and the two intermediate squares generated with the help of the 16 pointed star shape of the first square of the SCS (1.1 and 1.2).

(Page: 64)

Figure 3.10: Proportionate change in Ratios (2: 2.2: 2.4: 2.8 from 1: 1.1:1.2: 1.4) of the first, second and the two intermediate squares of the SCS when the dimension of the first square doubles from 1 to 2.

(Page: 65)

Figure 3.11: Change in proportions of the SCS when the *garbhagriha* wall coincides with, the first intermediate square, generated from the *marmas* of the 16 pointed star shape of the first square.

(Page: 65)

Figure 3.12: Change in proportions of the SCS when the *garbhagriha* wall coincides with, the second intermediate square, generated from the *marmas* of the 16 pointed star shape of the first square.

(Page: 65)

Figure 3.13: Geometrical relationship between the radius of the *rekha*, height of the *shikhara* and the *skandha* and the base of the *shikhara*.

(Page: 68)

Figure 3.14: The *rekha* segments shown as part of a complete circle, along with the height of the *shikhara*, the *skandha* and the base of the *shikhara*.

(Page: 68)

Chapter 4: Extracting Possible Solutions from texts on Sculpture and the Natyasastra

Figure 4.1: Derivations from the Setting, Polishing Action and Tracing Action of a Sculptural Diagram.

(Page: 74)

Figure 4.2: Vocabulary of Natyasastra being reduced to a square and a circle. (Courtesy Kapila Vatsyayan, 'The Silpa-panjara', in The Square and the Circle of the Indian Arts, 2nd edn. (New Delhi, Abhinav Publication, 1997), pp. 103-42, (p.123)

(Page: 75)

Figure 4.3: Application of terminology and proportions of human anatomy to a temple elevation (courtesy Sthapaka Niranjana Mahapatra).

(Page: 78)

Figure 4.4: Proportions of '*purusha*' ('*purusha*' image courtesy Vatsyayan) as applied to Chennakesava temple, Nagalpura (Chennakeshva image courtesy Hardy).

(Page: 78)

Chapter 5: An Analysis of Sri Yantra and its Application in Temple Architecture

Figure 5.1: Sri Yantra: Meru form generally used for meditation

(Page: 80)

Figure 5.2: The charkas and konas of the Sri Yantra superimposed on the plan of Rajarani temple, Bhubaneshwar (courtesy, Sthapaka Niranjana Mahapatra, Silparatnakosa, (New Delhi, IGNCA and Motilal Banarsidas Publishers Pvt. Ltd., 1994), p. 152, Fig. 56.

(Page: 81)

Figure 5.3: The Sri Yantra used for meditation purposes which can be encased in a circle and a square.

(Page: 84)

Figure 5.4: The Sri Yantra applicable for temple design and planning.

(Page: 84)

Figure 5.5: Sri Yantra, the angle of the enclosed triangles varying dramatically. Apexes of all the inverted triangles touch the bases of closest upright triangle, point 'm' and 'n'.

(Page: 86)

Figure 5.6: The triangles inside this Sri Yantra have variations (129°, 117°, 120°, 126°...) in their angles.

(Page: 86)

Figure 5.7: Sri Yantra, slight variation in the angle of the enclosed triangles accounting due to errors in drafting. Apexes of the inverted triangles do not touch the bases of closest upright triangle, point 'm' and 'n'.

(Page: 86)

Figure 5.8: The triangles inside this Sri Yantra have slight variations in their angles.

(Page: 86)

Figure 5.9: The *Sri Yantra*, properly drafted *ri Yantra* showing that the apexes of the inverted triangles which do not touch the bases of closest upright triangle will be used for temple design.

(Page: 88)

Figure 5.10: Correctly drafted *Sri Yantra* used for meditation.

(Page: 88)

Figure 5.11: Complete, correctly drafted *Sri Yantra* used for temple design.

(Page: 88)

Figure 5.12: Part *Sri Yantra* with the part Rajarani temple plan (courtesy Mahapatra, 1994, p. 151, Fig. 54).

(Page: 89)

Figure 5.13: Placement of the *Sri Yantra*, for derivation of key locations on plan (ref. Ch.3).

(Page: 89)

Figure 5.14: Placement of the *Sri yantra* for derivation of key locations on elevation, (ref. Ch. 3).

(Page: 89)

Figure 5.15: Square-Circle- Sequence with an off centered *garbhagriha.*

(Page: 90)

Figure 5.16: Nitya Nitya yantra with the 16 petals (courtesy Khanna, 2003, 1st print 1981, Fig.42)

(Page: 91)

Figure 5.17: Maniyamama temple Dedadara, Gujarat, c. A.D. 925, Square rotated to a 16 point star shape generate intersection points which on being projected yield location of points on the plan, (ref. Ch.3)

(Page: 91)

Figure 5.18: Jaina temple, Banpur, Madhya Pradesh, ca. A.D. 900-925, Joining of points on the 16-pointed rotated square, yield important edge point 'c′ -c′′', (ref. Ch. 3).

(Page: 91)

Figure A1, A2, A3.a, A3.b

(Page: 92)

Figure B1.a, B1.b, B2.a, B2.b, B3.a, B3.b, B4.a, B4.b.

(Page: 93)

Figure C1.a, C1.b, C2.a, C2.b, C3.a, C3.b, C4.a, C4.b, C5

(Page: 94)

Figure D1.a, D1.b, D3.a, D3.b, D4.a, D4.b, D5.a, D5.b, D6.a, D6.b

(Page: 95)

Figure F.1

(Page: 96)

Chapter 6: Mandala - An Incomplete Tool for Analysis of the Temple Plan

Figure 6.1: Map of (Madhya Prahesh) and Mundeswari (Bihar), (All maps here on if not otherwise mentioned modified after George Michell, *Hindu Art and Architecture*, (London, Thames and Hudson, 2000), p. 212)

(Page: 98)

Figure 6.2: Segment of the plan of Siva Temple, Mundeswari, Bihar, at the *jangha* level, which shows point 'X', not coinciding with the grid. Fig. 5 & Fig. 6 after Michael W. Meister, 'Mundesvari: Ambiguity and Certainty in the Analysis of a Temple Plan', in *Kaladarsana*, (*American Studies in the Art of India*) ed. by Joanna G. Williams, (New Delhi, 1991), pp. 77-89, (p.84)

(Page: 100)

Figure 6.3: Shiva temple at Mundeshvari, Shahabad District, Bihar, early seventh century. Ambiguities in interpretation (as shown by Meister) and the possible use of mandala (grid) as the definitive means of temple design.

(Page: 101)

Figure 6.4: Shiva temple at Mundeshvari, Bihar, assuming that the central pedestal is square, (which reflects problems with Meister's drawing) besides the central diagonal, no other diagonal grid line will pass through it.

(Page: 101)

Figure 6.5: Shiva temple at Mundeshvari, Bihar, SCS originate from the lingam circle. The SCS, before defining the octagonal characteristic of the inner sanctum wall, it establishes the orthogonally placed pedestal in the centre.

(Page: 102)

Figure 6.6: Shiva temple at Mundeshvari, Bihar,Use of SCS for the complete analysis and identification of the points on the temple plan.

(Page: 102)

Figure 6.7: Shiva temple at Mundeshvari, Bihar. Using the SCS for creating a diagonal gird (distance between the grid is equal to half the diagonal width of the first square of the SCS), which helps in locating the inner wall of the sanctum.

(Page: 103)

Figure 6.8: Shiva temple at Mundeshvari, Bihar. Geometrical analysis of the external wall profile using equal sub-division method.

(Page: 103)

Figure 6.9: Shiva temple at Mundeshvari, Bihar. Geometrical analysis of the external wall profile using equal radials

(Page: 103)

Figure 6.10: Shiva temple at Mundeshvari, Bihar. Geometrical analysis of the external wall profile using star formation

(Page: 106)

Figure 7.1: Udayeshvara temple, Udayapur, Madhya Pradesh, ca 1080 A.D. (courtesy Meister)
(Page: 108)

Figure 7.2: Udayeshvara temple, Udayapur, axonometric view (courtesy Hardy)
(Page: 110)

Figure 7.3: *Bhumija* Udayeshvara temple, Udayapur, Madhya Pradesh, ca 1080 A.D. (courtesy Meister, 1996, p.100, Fig. 38)
(Page: 110)

Figure 7.4: Map of Bhubaneshwar, Orissa
(Page: 110)

Figure 7.5: Brahmeshvara temple, Bhubaneshwar, Orissa, ca. A.D. 1060 (courtesy Hardy)
(Page: 111)

Figure 7.6: Brahmeshvara temple, Bhubaneshwar (courtesy Volwahsen, 1969, p.51)
(Page: 111)

Figure 7.7: The top right diagram shows the process of application of the expanded square and the bottom right shows the superimposition of a twelve-pointed star on this diagram. The left half of the diagram shows the process of application of geometry on the garbha-griha of the Lakshmana Temple, Khajuraho. Note the application of the diagonal grid and also the outline of the main spaces, which fall on the grid. Image of Lakshmana temple is courtesy, Krishna Deva, Temples of Khajuraho: ASI, Architectural Survey of the temples, No 5 Plates (New Delhi, Archeological Survey of India, 1990).
(Page: 114)

Figure 7.8: Brahmeshvara temple, Bhubaneshwar, Orissa. Application of SCS on Volwahsen's drawing
(Page: 115)

Figure 7.9: Brahmeshvara temple, Bhubaneshwar, Orissa. Dual Application of SCS, starting from the *garbhagriha* as well as, from the *Mandapa*. The eleventh SCS circle originating from the core of the *garbhagriha* touches the tenth square of the SCS originating from the *Mandapa*, defining the relationship and distance between the two core centres
(Page: 116)

Figure 7.10: Brahmeshvara temple, Bhubaneshwar, Orissa. The origin of the SCS is the circle of the lingam. The SCS defines the proportion between the lingam, yoni-*pitha*, *garbhagriha* inner wall. It also relates to the *antarala* wall edge
(Page: 116)

Figure 7.11: Brahmeshvara temple, Bhubaneshwar, Orissa. Identification of the antarala, inner and outer wall profile, and the lines governing chandrashila form.
(Page: 117)

Figure 7.12: Brahmeshvara temple, Bhubaneshwar, Orissa. Location of edge of the nandi image in the Mandapa can be defined.
(Page: 117)

Figure 7.13: Brahmeshvara temple, Bhubaneshwar, Orissa. The exactly similar geometrical sequence of the SCS applied to the mandapa yields locations on the inner wall edge of the mandapa, location of the pratiratha, edge of the entrance doorway. The 'Axix of Union' which is the intersecting line between the two SCS systems defines the edge of the Mandapa.
(Page: 117)

Figure 7.14: Brahmeshvara temple, Bhubaneshwar, Orissa. Intersection points (*Marmas*) possibly define the intricate modulations in profile of *bhadra, pratibhadra and karna* (only for sanctum) edges of the sanctum and *mandapa*.

(Page: 118)

Figure 7.15: Brahmeshvara temple, Bhubaneshwar, Orissa. Intersection points (*Marmas*), possibly define the intricate modulations in profile of *bhadra, pratibhadra* and *karna* edges of the sanctum.

(Page: 118)

Figure 7.16: Brahmeshvara temple, Bhubaneshwar, Orissa. Intersection points (*Marmas*), possibly define the intricate modulations in profile of *bhadra, pratibhadra* edges of the *mandapa*.

(Page: 119)

Figure 7.17: Brahmeshvara temple, Bhubaneshwar, Orissa. Location of the *karna* edge of the *mandapa* is defined by the intersection of the 'line of union' and the diagonal ray originating from the center of the *garbhagriha*. The relationship between the temple and its ancillary shrines is also established with the help of SCS's ninth square. The location of the peripheral wall can also be established with the help of SCS's tenth square.

(Page: 119)

Figure 7.18: Brahmeshvara temple, Bhubaneshwar, Orissa. The governing diagonal rays originating from the center and the mid points of the SCS squares of the *garbhagriha* and the *Mandapa* define the location and proportion of the *bhadra* and *karna* of the ancillary shrines.

(Page: 120)

Figure 7.19: Brahmeshvara temple, Bhubaneshwar, Orissa. The governing diagonal rays originating from the center and the mid points of the SCS squares of the garbhagriha help define the location of the bhadra and karna of the ancillary shrines closer to the prasada in the west.

(Page: 120)

Figure 7.20: Brahmeshvara temple, Bhubaneshwar, Orissa. The amount of the shift in the length at the *mandapa* side, with respect to the ancillary shrines, derives its value from, the *garbha-griha* dimensions (half its width = a') of the *prasada*.

(Page: 121)

Figure 7.21: Brahmeshvara temple, Bhubaneshwar, Orissa. The distance between the edge of the *Mandapa* wall and the 'line of union' is equal to half the diameter of the yoni-*pitha* (a'' = e).

(Page: 121)

Figure 7.22: Brahmeshvara temple, Bhubaneshwar, Orissa. The width of the wall is equal to, the perpendicular distance between the diagonal projections from the center of the *mandapa* and the mid point of Fourth Square of the SCS.

(Page: 122)

Figure 7.23: Brahmeshvara temple, Bhubaneshwar, Orissa. The modulations of the eastern boundary wall are direct projections of points of the SCS.

(Page: 122)

Figure 7.24: Brahmeshvara temple, Bhubaneshwar, Orissa. The modulations of the all the peripheral

(Page: 123)

Chapter 8: Solving the Complexity of a Complex Temple Layout with the SCS Method

Figure 8.1: Map of Tanjavur, Tamil Nadu (adapted after George Michell)

(Page: 124)

Figure 8.2: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur, Tamil Nadu, ca. A.D. eleventh century (courtesy AIIS)

(Page: 126)

Figure 8.3: The ground plan of Brihadeshvara temple Complex, Tanjavur. (courtesy Volvahsen, 1969, p.87)

(Page: 126)

Figure 8.4: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur (courtesy AIIS)

(Page: 127)

Figure 8.5: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur, ground plan. The dimensions and proportions of the *garbhagriha* of the Rajarajeshwara *vimana* governs the dimensions of its *ardhamandapa, mahamandapa, mandapa* and the flight of steps in front.

(Page: 128)

Figure 8.6: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The originating circle of the SCS is the Shiva-*linga* in the center.

(Page: 128)

Figure 8.7: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The distance between the *mahamandapa* pillars and the width of the projection in the *mandapa*, is equal to the side of the sixth square.

(Page: 128)

Figure 8.8: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The entrance to the mahamandapa, is equal to the first square of the SCS.

(Page: 129)

Figure 8.9: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The entrance to the mahamandapa, is equal to the first square of the SCS.

(Page: 129)

Figure 8.10: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. Location of the inner side of the *ardhamandapa* wall, as well as, the inner edge of the wall-recesses.

(Page: 129)

Figure 8.11: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. External side of the *ardhamandapa* wall and the bottom edge of the combined projected plinth of the *ardhmandapa* and the *mahamandapa*, originates from the *marmas* of the seventh rotated square of the *garbhagriha* SCS.

(Page: 130)

Figure 8.12: Rajarajeshwara shrine, Brihadeshvara temple,Tanjavur. The location of the internal and external edges, of the outer garbhagriha wall.

(Page: 130)

Figure 8.13: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The distance from the enclosure wall (*prakara*), to the common wall between the *ardhamandapa* and the *mahamandapa* is 'Ld1'. The distance from this wall, to the end of platform, on which the huge, monolithic *Nandi* is seated, in another *Chola* design moulded platform is 'Ld2'. If the length of the temple is 'Lt', then it was found that, Lt = Ld1 = Ld2.

(Page: 130)

Figure 8.14: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationship of the main temple with the subsidiary shrines 'T4', 'T6' and 'T12' can be established.

(Page: 131)

Figure 8.15: Candeshvara temple, Brihadeshvara temple complex, Tanjavur

(Page: 131)

Figure 8.16: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The third square of the SCS coincides with the *antarabhitti*

(Page: 132)

Figure 8.17: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The projections from SCS define the columns of the *ardhamandapa* and the wall of the *antarala*

(Page: 132)

Figure 8.18: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The *marma* projections from SCS, which define the columns of the *ardhamandapa* and the wall of the *antarala*

(Page: 132)

Figure 8.19: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The doorway leading to the *antarala* is defined

(Page: 132)

Figure 8.20: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The width of the flight of steps 'g'' can be derived from the projected line starting at the corner of the third square of the SCS which is also the *garbhagriha* wall.

(Page: 132)

Figure 8.21: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The width of the doorway into the *vimana* is governed by the projections 'g-g'' and 'h-h''. Also note derivations from projection 'f-f''.

(Page: 132)

Figure 8.22: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. I have shown that the marma 'b' will be giving us the location of the plinth of the *vimana*.

(Page: 133)

Figure 8.23: Candeshvara temple, Brihadeshvara temple complex, Tanjavur. The application of SCS and its geometrical dervations to the ardhamandapa.

(Page: 133)

Figure 8.24 & 8.25: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationships of the Brihadeshvara temple vimana, with the subsidiary shrines are shown.

(Page: 134)

Figure 8.26 & 8.27: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationships of the Brihadeshvara temple *vimana*, with the subsidiary shrines are shown.

(Page: 135)

Figure 8.28: Rajarajeshwara shrine, Brihadeshvara temple, Tanjavur. The relationships of the Brihadeshvara temple *vimana*, with the front *gopura* are shown.

(Page: 136)

Figure 8.29: Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. Geometrical Analysis through application of SCS.

(Page: 136)

Figure 8.30: Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. Geometrical Analysis through application of SCS.

(Page: 136)

Figure 8.31: Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.

(Page: 137)

Figure 8.32: Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.

(Page: 137)

Figure 8.33: Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.

(Page: 138)

Figure 8.34: Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The geometrical analysis of *Nandi mandapa* and other subsidiary shrines.

(Page: 138)

Figure 8.35: Nandi Mandapa, Brihadeshvara temple complex, Tanjavur. The study of the proportional relationship between main shrine, *Nandi mandapa*, other subsidiary shrines and the peripheral wall.

(Page: 139)

Figure 8.36: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

(Page: 139)

Figure 8.37: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex

(Page: 140)

Figure 8.38: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

(Page: 141)

Figure 8.39: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex

(Page: 142)

Figure 8.40: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

(Page: 142)

Figure 8.41: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

(Page: 143)

Figure 8.42: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

(Page: 144)

Figure 8.43: Brihadeshvara temple complex, Tanjavur. Geometrical analysis of the complete complex.

(Page: 145)

The Author is an Architect by profession with a PhD in Architecture: "Geometrical Analysis of North Indian Temple Architecture" from Cardiff University, U.K. She has received her Master's degree in Industrial Design from Indian Institute of Technology, Delhi. She was awarded Gold medal – Architecture, University of Mangalore in 1993 from MIT, Manipal.

Dr. Ananya Gandotra has travelled extensively throughout Madhya Pradesh, during and after the research work of this book. This book is to be followed by her next documentation and analytical endeavor titled "Theories in Indian Temple Architecture". Although the focus would be temples in India, harmonic progression of the *Rekha Sutra*, ceiling geometry, structural systems, evolution of space and the patterns evolving out of its devotional function would be rendered across regions.

While "Indian Temple Architecture-Analysis of Plans, Elevations and Roof Forms" originates the theory of Square-Circle-Square (SCS), the theories of the SCS would be further established with detailed examples, including those transcending borders viz, - Temple of Heaven, Beijing, China.

Presently she is the Head, Technical Services Group - Corporate Projects, The Indian Hotels Company Limited.

Dr. Gandotra lives in India with her husband and two children.

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